

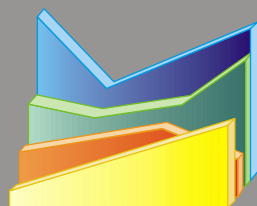
DOE Performance Indicators for Environment, Safety & Health

Report Period Ending
December 1997

April 1998

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Office of
Environment,
Safety and Health



**DOE Operating
Experience Analysis**

Safety Management Through Analysis

This report is available via the World Wide Web at <http://www.oh.doe.gov/pl>

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Introduction

This Performance Indicator Report covers the last two quarters in calendar year 1997. We are issuing a combined report to permit getting the publication on a more timely schedule. Our goal is to issue these reports approximately 90 days after the data cut-off.

Integrated Safety Management

During 97Q3 and 97Q4, considerable attention has been applied throughout DOE to the Integrated Safety Management System (ISMS). As stated in the SMS Guide (DOE G 450.4.1) and the Line ES&H Oversight Policy (DOE P 450.5), work processes and organizational safety management should be routinely measured and evaluated. The corporate level performance indicators in this report might serve as a starting point for a local set of measures. However, local measures will be unique to local processes, aligned with local goals, and probably should not be the same as this corporate set. Call on EH if you need ideas or suggestions, or just an external peer review.

New Format

As you review the pages of this report, you will notice a new color format. Actually, you are not supposed to notice it if we are successful! The two-color printing in this report is significantly less expensive than the previous four-color version. Please give us some feedback as we decide whether to continue with this format.

Sharing Analysis Techniques

One of the responsibilities of our office is to share analysis techniques, data sources, and performance measures with the Complex to foster the role of data analysis in an overall safety management model. Please put our office on distribution for your local performance measures and analysis products so that we may learn from you.

Assessment

Contained in this report are the following significant observations:

- Both the Lost Workday Case Rate and the Occupational Safety and Health Cost Index continue to demonstrate favorable trends, indicating a reduction in both the frequency and severity of occupational injuries and illnesses within the Department. (See PI-1 and 2)
- In 97Q3, there was a dramatic increase in the number of cited environmental violations at DOE facilities and associated fines. This was primarily due to one Notice of Violation at the Idaho National Engineering and Environmental Laboratory, citing 135 Resource Conservation and Recovery Act violations with fines totaling \$892,725. (See PI-7)
- The total number of cases reviewed by the Price-Anderson Amendments Act (PAAA) Enforcement Office continues an increasing trend due largely to Enforcement Office infrastructure development. In 97Q4, the PAAA issued civil penalties totaling \$348,750, of which \$142,500 was waived. (See PI-9)
- The radiation dose to the public continued to demonstrate an improving trend and is at its lowest level since 1990. This trend is attributable to reduced nuclear production activities. (See PI-10)
- Between 1995 and 1996, the DOE collective total effective dose equivalent (TEDE) decreased by 10 percent due to decreased doses at 5 of the 7 sites with the highest radiation dose. In addition, the average dose to workers with measurable dose decreased by six percent. (See PI-11)

- There were four confirmed cases of internal contamination in 97Q4. This represents a significant reduction compared to the previous three quarters, in which there was an average of nine confirmed cases of internal contamination reported per quarter. (See PI-12)
- In 97Q4, there were 65 reported events involving safety system actuations. Of these 65 events, 25 involved the loss of process ventilation, 13 at the Hanford site. The 13 events at Hanford represent a significant increase over historical data. (See PI-15)
- In 97Q3, DOE met only 67 percent of its enforceable milestones in the agreed to timeframe. This represents the poorest Departmental performance over the past five years. (PI-17)

Detail slots are still available in our office for FY98 and FY99. We bear most of the travel/living expenses for these details. Over the past two years, four detailees from the field have gained a better understanding of Headquarters' operations by participating in our analyst detailee program. We most recently hosted two Russian engineers representing GAN, Russia's Federal Nuclear and Radiation Safety Authority (GOSATOMNADZOR). We believe these detail opportunities are mutually beneficial. We gain valuable field insights and experience to improve our products and you gain exposure to ES&H analysis techniques and a Headquarters perspective on the development and utility of emerging programs. All past detailees have indicated that they increased their knowledge and skills in analysis of environment, safety and health data. If you or someone you know is interested in our detailee program, please email an attached resume to Andy.Marchese@eh.doe.gov.

This report and additional analytical tools, techniques, and data can be found at our Internet Web site. Please visit us at <http://tis.eh.doe.gov/web/oeaf>.



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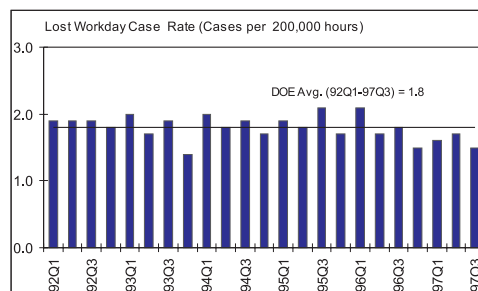
[Detail Opportunities](#)

[On the Web](#)

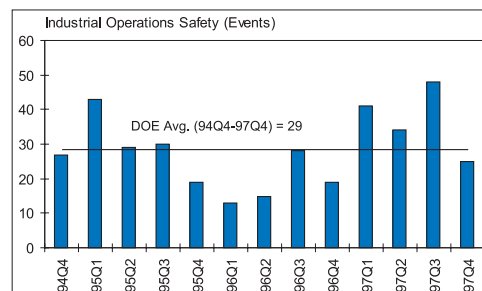
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Management Summary

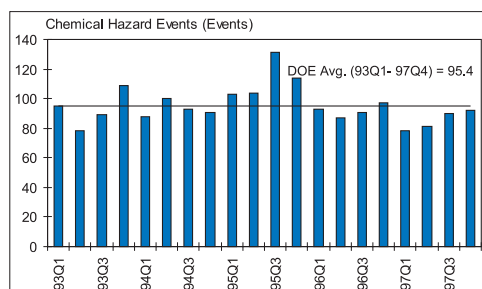
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. The horizontal lines on the graphs represent the DOE averages. Quarterly data is presented as calendar quarters.



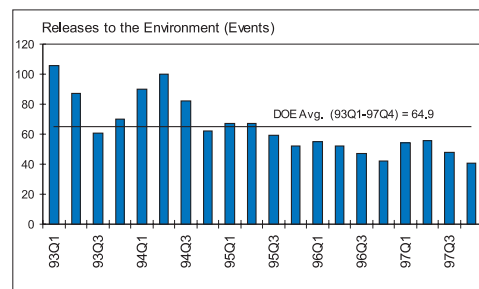
A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



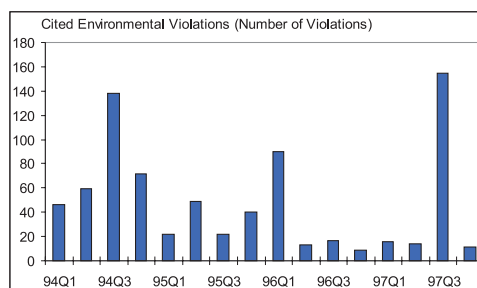
The number of operations-related events involving construction equipment, machining operations, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



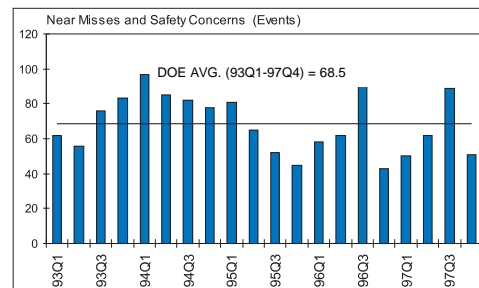
The number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Number of environmental violations cited in enforcement actions by regulators at DOE facilities.



A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain.

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List of Performance Indicators

The performance indicators are organized into four major categories. The numbers correspond to the section numbers used in this report.

1. Accidents/Events that have already happened

Accidents/Events are injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Chemical Hazard Events
6. Reportable Occurrences of Releases to the Environment
7. Cited Environmental Violations
8. Environmental Permit Exceedances
9. Price-Anderson Amendments Act Enforcement
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events

2. Precursors to accidents and near misses

Precursors are events which resulted in significant reduction of barriers that are depended upon for safety.

13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
15. Safety System Actuations
16. Safety Equipment Degradation

3. ES&H Management

ES&H Management includes work planning, training, manager and worker involvement, and regulatory compliance.

17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations
19. Enhanced Work Planning Implementation

4. Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
21. Waste Generation
22. HEU Vulnerabilities Resolved

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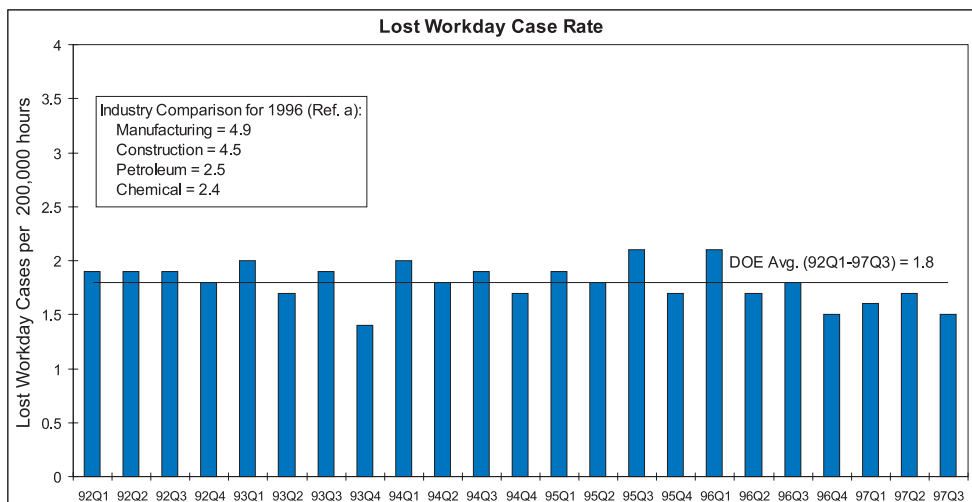
Indicator

1. Lost Workday Case Rate

Definition

Work-related injury or illness that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) Rate is the number of lost workday cases per 200,000 hours worked.



Source: DOE Data - Computerized Accident/Incident Reporting System; Private Sector Data - Department of Labor, Bureau of Labor Statistics.

Key Observations

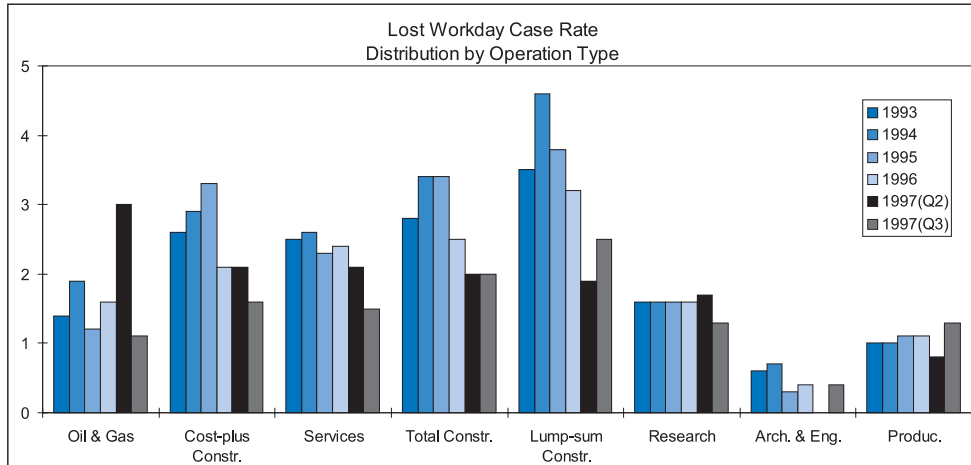
- Preliminary estimates for the first three quarters of 1997 indicated that 1,525 cases were serious enough to cause either days away from work, days of restricted work activity, or both. About one third of these cases occurred during the third quarter.
- The DOE lost workday case incident rate was 1.5 per 200,000 hours worked for 97Q3 and 1.6 per 200,000 hours worked for 1997 through the third quarter. For DOE contractors engaged in production, research, and architectural and engineering activities, their rates through the third quarter were below the DOE average.
- The average number of lost workdays per lost workday case was 19.1 days for 1997 through the third quarter.

Additional Analysis

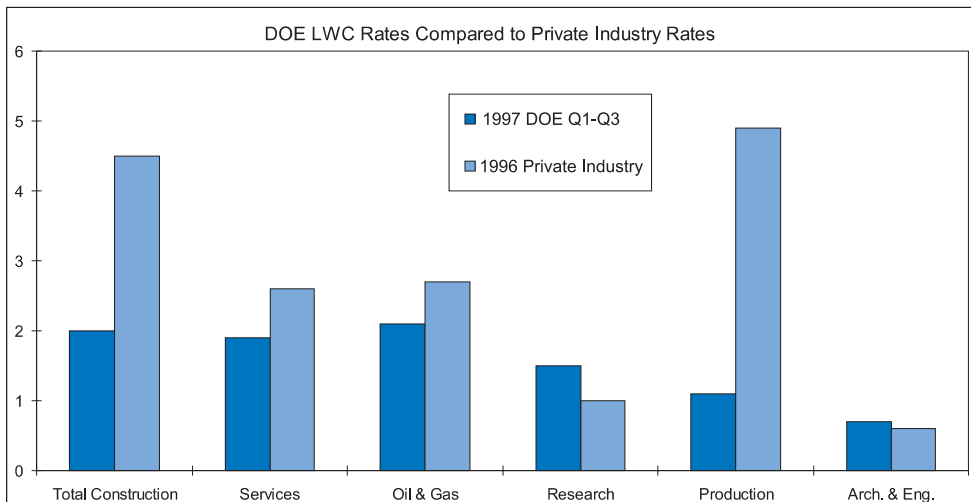
- Year-to-date estimates showed that during the first three quarters of 1997, research, services and production operations accounted for the largest proportion of lost workday cases: 38 percent, 27 percent, and 16 percent respectively. Collectively, these three operation types employed about 87 percent of the FTEs and accounted for about 80 percent of the lost workday cases.

^a From Table 1. Incidence Rates of Nonfatal Occupational Injuries and Illnesses, by Industry Division, Selected Industries and Case Type, 1996 – Department of Labor, Bureau of Labor Statistics.

- Lost workday cases continued to account for nearly half of the total recordable cases (47 percent for 1997 through the third quarter).
- The following graph shows a comparison of 1997 LWC rate distributed by operation type compared to the past five years. The 97Q3 top contributor was lump-sum construction.



- Very general rate comparisons for some operation types could be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE fell into several industry classifications, including construction, manufacturing, oil and gas extraction, and research. The graph below shows a comparison of 1997 Q1-Q3 DOE LWC rates with 1996 private industry rates (the most recent BLS survey).



Indicator

2. Occupational Safety and Health Cost Index

Definition

Represents the amount of money lost to injuries/illnesses for every hour worked by the total work force. The index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The index is computed as follows:

$$\text{Cost Index} = 100[(1,000,000)D + (500,000)T + (2,000)LWC + (1,000)WDL + (400)WDLR + (2,000)NFC] / \text{HRS}$$

where

D = the number of deaths,

T = the number of permanent transfers or terminations due to occupational illness or injury,

LWC = the number of lost workday cases,

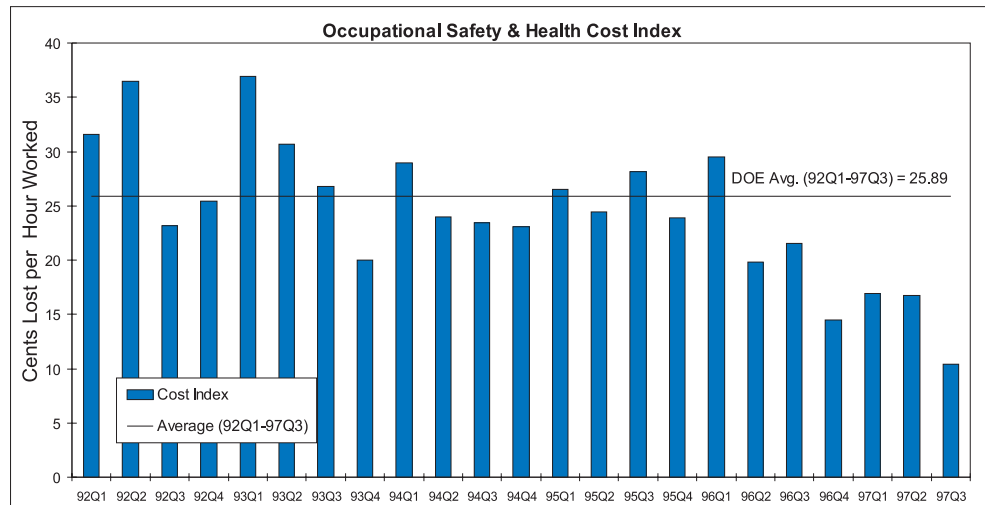
WDL = the number of days away from work,

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.

The coefficients are weighting factors that were derived from a study of the direct and indirect dollar costs of injuries.



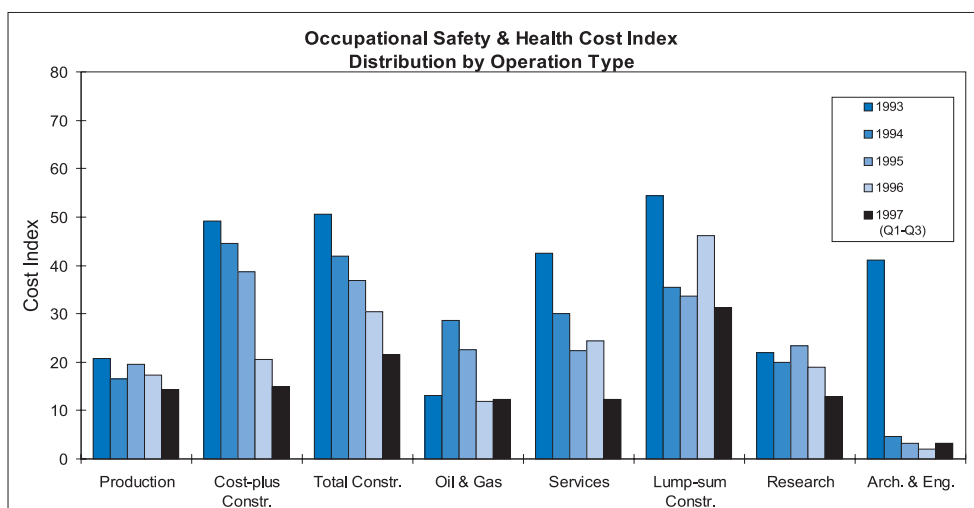
Source: Computerized Accident/Incident Reporting System.

- DOE-wide the Cost Index for 1997 through the third quarter was 14.61. Although fatalities, transfers, and terminations due to illness or injury were weighted the highest in the calculation, fluctuations in the other components of the equation or calculation often had a greater effect on the index.
- Revisions in lost worktime and late reporting would affect the Cost Index; however, the downward trend was expected to continue.

Key Observations

- The following graph shows the Cost Index, distributed by operation type, for the years 1993 to 1997. Preliminary estimates indicated that the 1997 Cost Index for most operation types were below the 1996 level. Operations involving lump-sum construction activities reported the highest index for 1997 (Q1-Q3), 31.25.

Additional Analysis

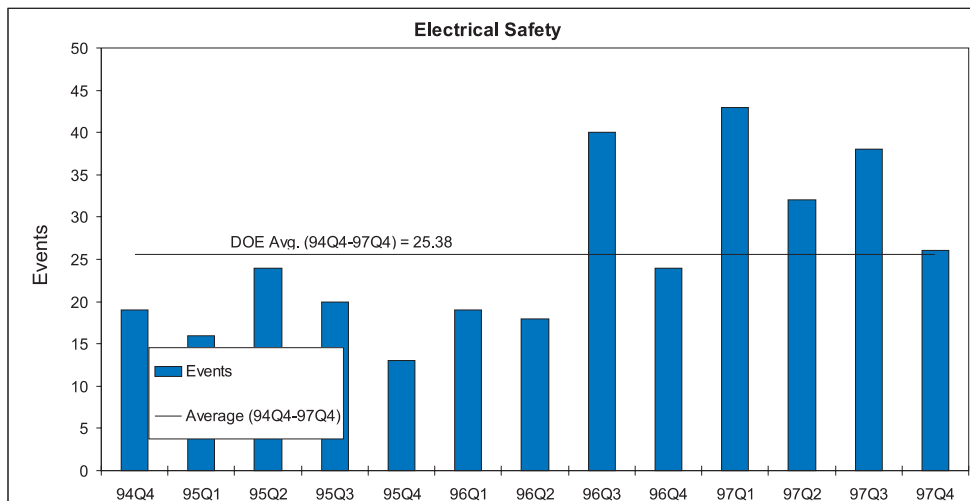


Indicator

3. Electrical Safety

Definition

Number of events involving worker contact or the potential for contact with electrically energized equipment. These events are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department Analysts.

Key Observations

- Of the 38 events reported in 97Q3, 7 events involved a person actually receiving an electrical shock. Two of the events were reported as minor and there were no serious shock events requiring hospitalization. Of the 26 events reported in 97Q4, 7 events involved a person actually receiving an electrical shock. Two reported events were electrical burns and one was a serious electrical flash-over event requiring hospitalization. The average number of events reported for the last 13 quarters was 25.38 events per quarter. The noted increase in electrical events over FY96 coincides with an increase in maintenance and construction activities at the major sites as reported by site personnel.
- Excavation, drilling, and cutting operations continued as the most frequent activities leading to electrical events.

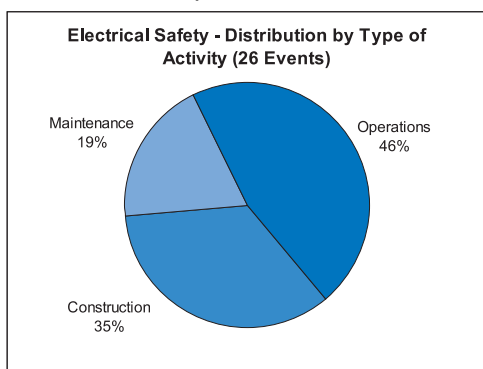
Additional Analysis

- In 97Q3, there had been no serious injuries from electrical accidents for the third consecutive quarter. In 97Q4, two of the events reported were listed as electrical burns due to flash-over. In one individual's case, the resulting second and third degree burns required a seven-day hospital stay. A total of four individuals were injured due to electrical flash-over for 97Q4. Electrical flash-over events remained a high risk for injury (i.e., if there were an electrical flash-over, there was a high chance of injury).
- A Field investigation report for the electrical arc blast at Building F-Zero, Fermi National Accelerator Laboratory was released on October 22, 1997. The final report noted that the national average for deaths in the workplace is in a slow decline, while the national average for electrical deaths is on an increase.

- The number of personnel actually receiving an electrical shock for CY95 was 12 and for CY96 was 20. Over the last year, CY97, that number increased to 27 electrical shock events.

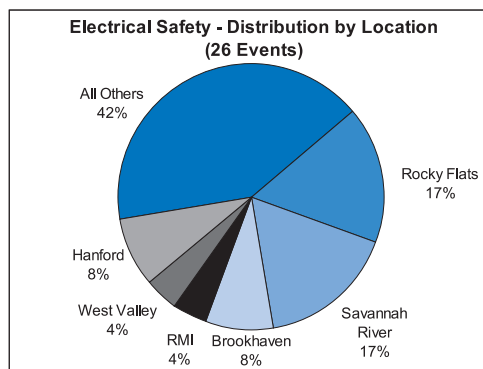
Distribution by Activity

- The electrical safety events reported for 97Q4, fell into three major categories: construction, maintenance, and operations activities.



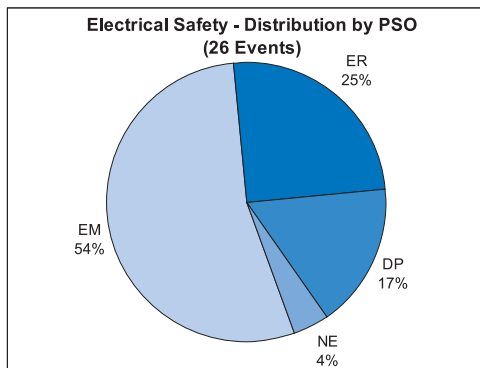
Distribution by Location

- The number of events (26) for 97Q4 was distributed among all sites, with no site reporting more than 4 events. Savannah River, Rocky Flats, Oak Ridge and Hanford tend to have the largest number of reported events. This was to be expected based on the level of construction, maintenance, and demolition at these sites.

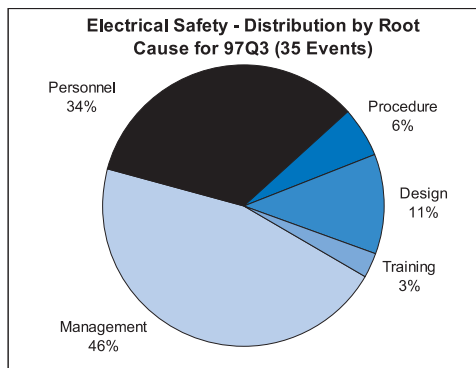


Distribution by PSO

- During 97Q4, the Office of Environmental Management (EM) had 15 of the 26 events. This was consistent with EM's having ownership of a majority of the facilities within the DOE Complex. EM averaged 11 electrical events per quarter over the last 13 quarters.

**Distribution by Root Cause**

- In 97Q3^a, of the 35 root causes identified, 12 were attributed to personnel error and 16 were attributed to management problems.



^a Root cause analysis is performed for 97Q3 (with the exception of PI 5, Chemical Hazard Events) due to the time lag to perform the analysis.

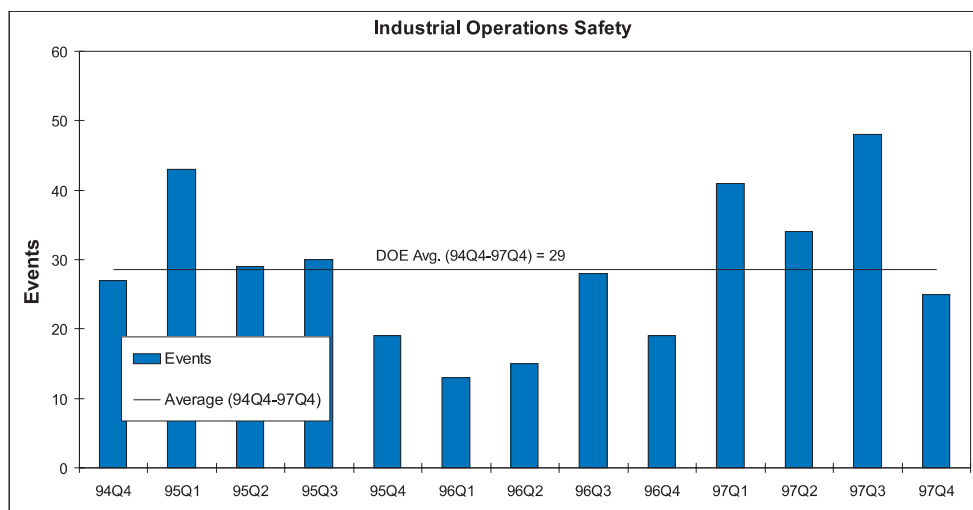
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Indicator

4. Industrial Operations Safety

Definition

Number of operations-related events involving construction equipment, forklift operations, machining operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department Analysts.

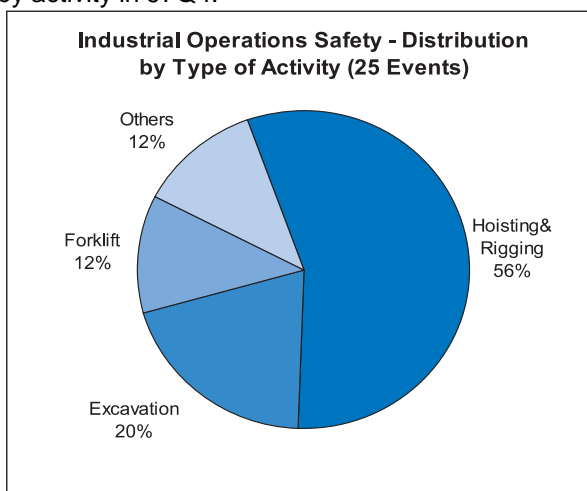
Key Observations

- Industrial operations safety related events decreased nearly one-half from 48 in 97Q3 to 25 in 97Q4. From the data shown in the above chart, the change could be attributed to a cyclical phenomenon due to increased work activity at the end of the fiscal year (i.e., third quarter) and decreased activity due to the holiday seasons in the fourth quarter.

Additional Analysis

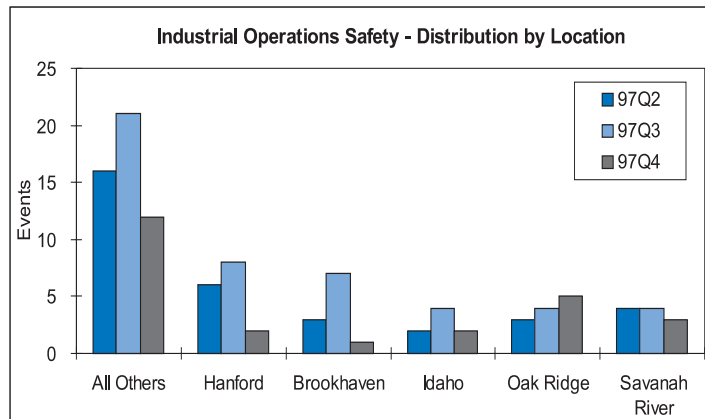
Distribution by Activity

- This chart represents a distribution of the number of industrial operations safety related events by activity in 97Q4.



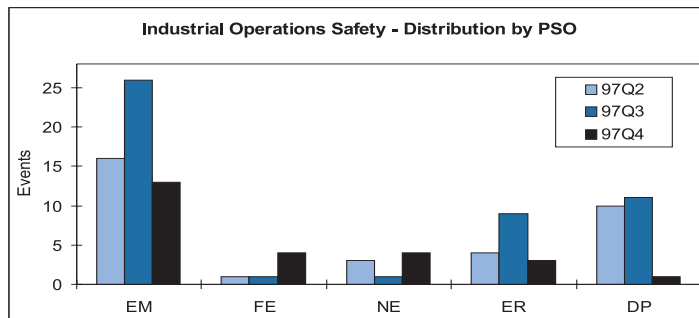
Distribution by Location

- This chart shows distribution by location for the most recent quarters.



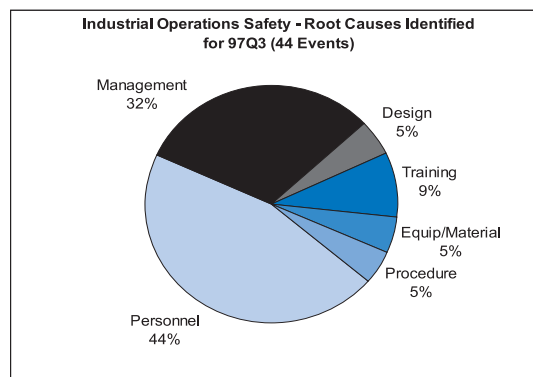
Distribution by PSO

- Distribution by Program Secretarial Offices (PSO) is shown in this chart. Although EM had cut its reportable events in half from the previous quarter, it continued to lead with 52 percent of all DOE Industrial Operations safety-related occurrences in 97Q4. It is expected that EM will continue to lead with the majority of Industrial Operations safety-related occurrences in view of its level of activity.



Distribution by Root Cause

- In 97Q3, root causes were identified for 44 occurrences.



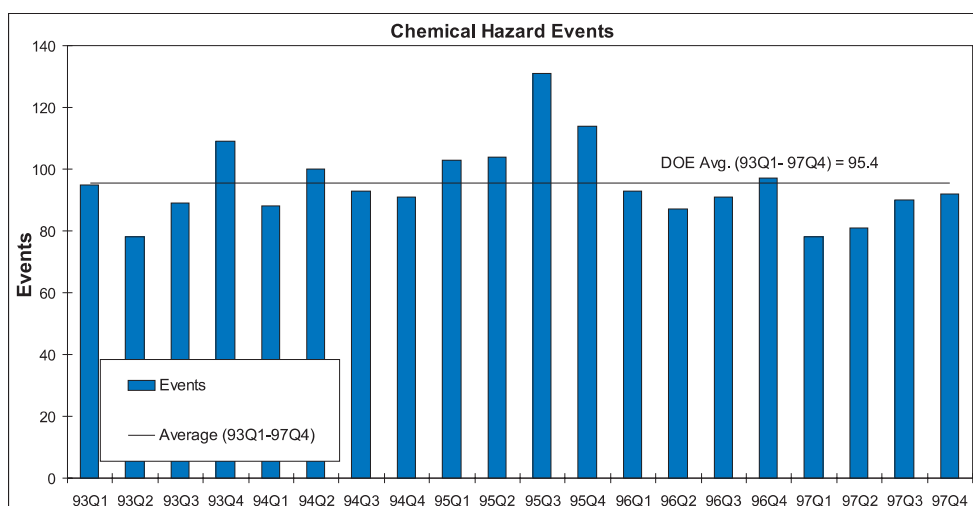
Indicator

5. Chemical Hazard Events

Definition

Number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

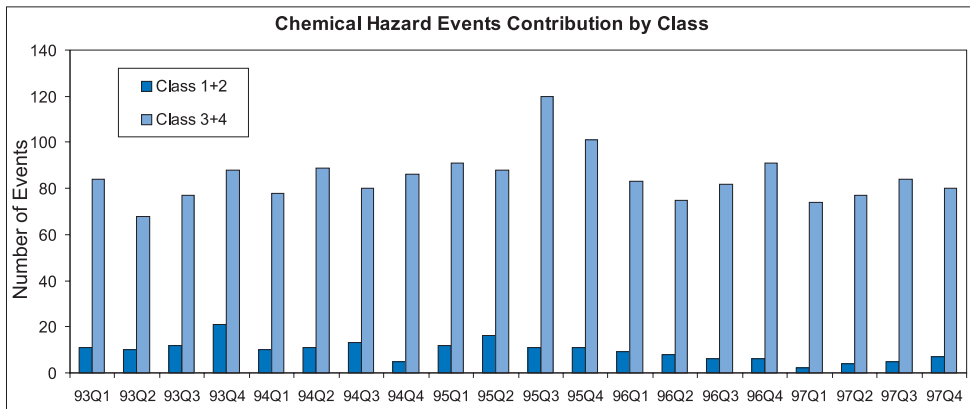
- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases which are significant by the frequency, but not by the consequences.



Source: *Chemical Safety Concerns: A Quarterly Review of ORPS October-December 1997*. US Department of Energy, Office of Field Support, EH-53 (draft as of January 1998). World Wide Web at <http://www.dne.bnl.gov/etd/csc/>

Key Observations

- There were slight increases in the number of chemical hazard events in 97Q3 and 97Q4; however, the number of events in 97Q3 (90) and in 97Q4 (92) remained below the five-year average (93Q1-97Q4) of 95.4. Since 95Q3, there has been an overall decreasing trend in the number of chemical hazard events.
- Class 1 and 2 events showed short-term increases for the last four quarters. There were only 18 Class 1 and 2 events for 1997 compared to 29 in 1996 and 50 in 1995.



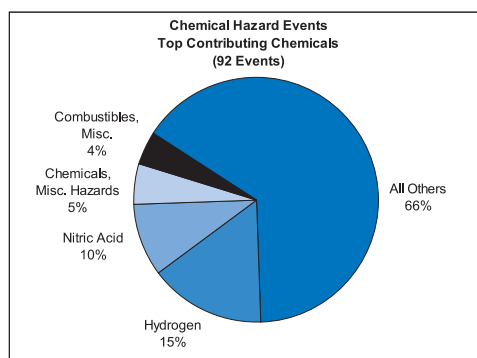
Characterization of Chemical Hazard Events

- During 97Q3, there were:
 - One Class 1 event at Hanford's Plutonium Finishing Plant (PFP) that involved the explosion of legacy chemicals.
 - Three Class 2 events, including:
 - A "rapid over-pressurization" of a waste chemical container at Fernald,
 - An employee exposure to dielectric fluid at Rocky Flats, and
 - The discovery of a chemical that became unstable due to refrigeration at Lawrence Livermore National Laboratory (LLNL).
- During 97Q4, there were:
 - One Class 1 event at Idaho National Environmental Laboratory (INEEL) involving an unprotected employee sprayed with sulfuric acid.
 - Six Class 2 events, including:
 - An acid solution eruption at Argonne National Laboratory (ANL),
 - An employee splashed with sodium hydroxide at Savannah River,
 - An acid release at Savannah River,
 - A caustic aerosol release at Energy Technology Engineering Center (ETEC), and
 - Two fish/salamander kills at Oak Ridge due to chlorine releases.

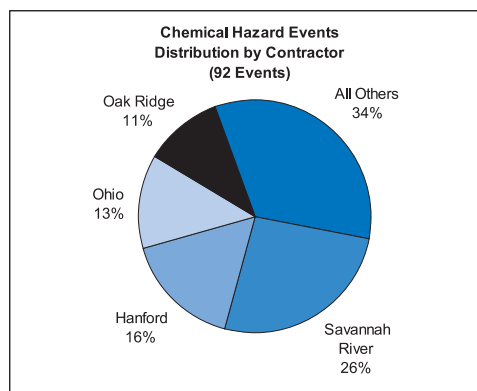
Additional Analysis

Distribution by Chemicals Involved

- The chemicals most often involved in chemical hazard events during 97Q4 are identified in this chart. In this quarter, hydrogen (14 events) and nitric acid (9 events) were the leading contributors at 25 percent with most events occurring at Savannah River. This trend of chemical distribution was also observed for 97Q3.
- According to Field personnel, of the 14 hydrogen chemical hazard events, there were issues related to:
 - Pressure build-up in containers at Savannah River, Los Alamos National Laboratory (LANL), and Hanford, and
 - An ignition and a small fire at Y-12 in Oak Ridge.
 - There also were issues concerning Class 3 and 4 events involving ventilation or detector/analyzer degradations at the Savannah River Defense Waste Processing Facility and Hanford Tank Farms.

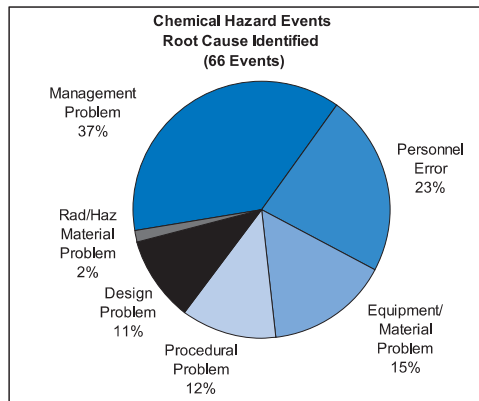
**Distribution by Location**

- The major contributors to chemical hazard events in 97Q4 are identified in the chart below. Savannah River and Hanford were the top two contributors in both 97Q3 and 97Q4. There was a decreasing trend in the number of chemical hazard events observed at Savannah River since 95Q3. Since 96Q2, there was an increasing trend in the number of events at Hanford.



Distribution by Root Cause

- The root cause distribution for 97Q4 is shown in this chart for those events in which a root cause has been identified. Sixty percent of the root causes identified were management problems or personnel errors. This distribution was observed for 97Q3 as well.

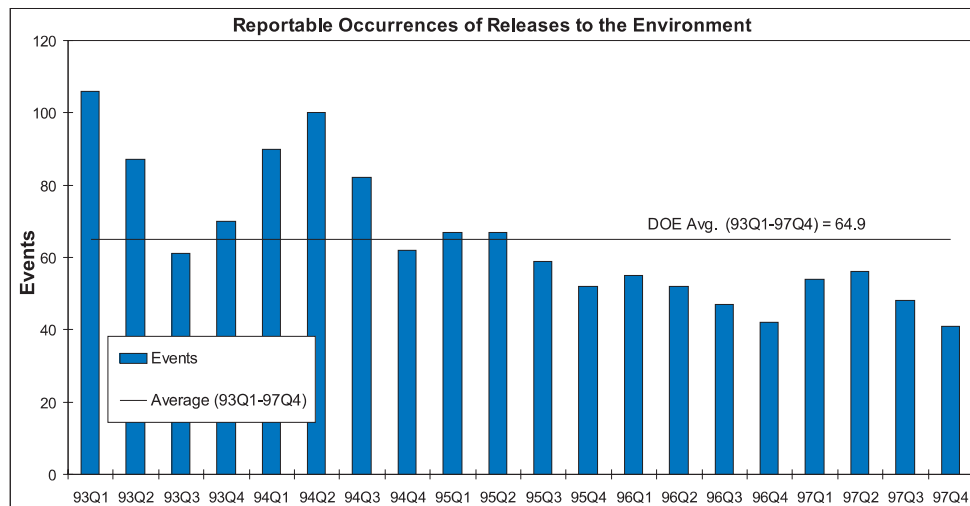


Indicator

6. Reportable Occurrences of Releases to the Environment

Definition

Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Source: Review of Occurrence Reports by Department Analysts.

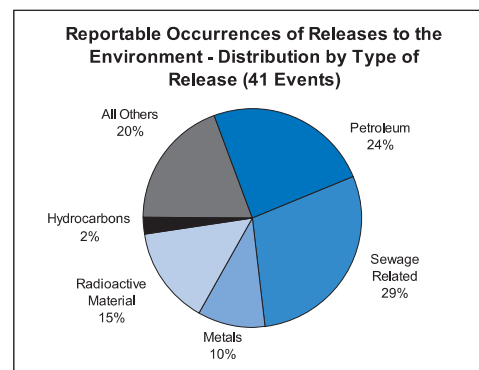
Key Observations

- The data continued to show a downward trend over the past 20 quarters.

Additional Analysis

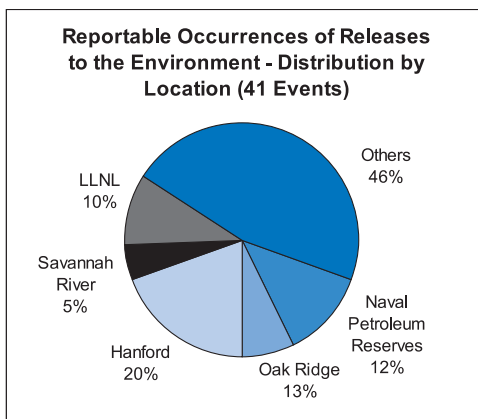
Distribution by Type of Release

- The types of releases are shown in this chart for 97Q4. Petroleum and sewage releases continued to have the highest numbers.
- The total amount of spilled crude oil reported in ten events for 97Q4 was 132 barrels (106 barrels recovered). Also, 70 gallons of hydraulic fluid were released to the environment. Petroleum releases, being 24 percent of the total reportable occurrences, was consistent with the past 7 quarters.



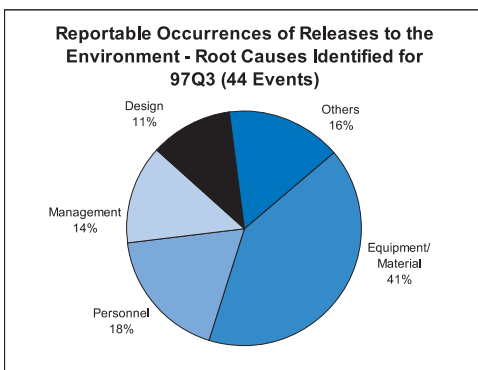
Distribution by Location

- Only two locations contributed five or more events. Hanford had the highest number (eight) of the reported releases for 97Q4.



Distribution by Root Cause

- The equipment/material root cause accounted for 18 of the root causes identified for 97Q3.

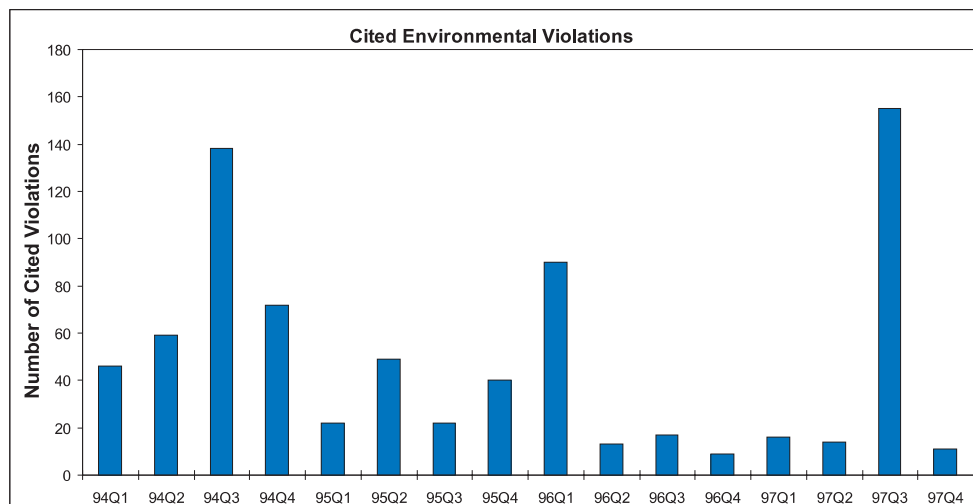


Indicator

7. Cited Environmental Violations

Definition

Number of environmental violations cited in enforcement actions by regulators at DOE facilities.



Source: EH-41 Compliance Database.

Key Observations

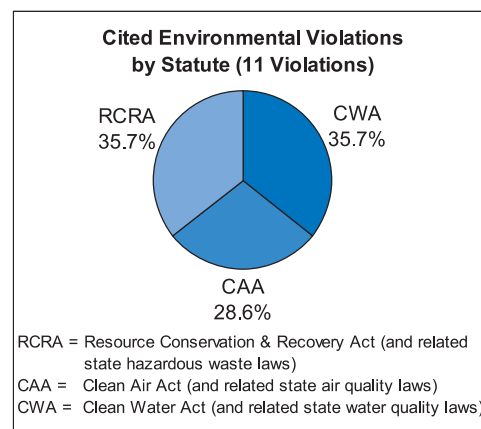
- Violations in 97Q3 reached a four-year high, with 155 cited violations, of which 135 of them were for a single Notice of Violation (NOV) issued to Idaho National Engineering and Environmental Laboratory (INEEL). Eleven cited violations during 97Q4 were well within the range of data of the last six reported quarters.
- Two large fines were assessed under RCRA for 97Q3: \$892,725 at Idaho, and \$110,000 at the Savannah River Plant. In the past two years, all fines greater than \$100,000 and most fines greater than \$10,000 have been for RCRA violations.

Additional Analysis

- NOVs in 97Q3 and 97Q4 were within the range of data for past quarters. Since a single NOV can cite one or numerous violations, the number of violations cited is much more variable than the number of NOVs received.

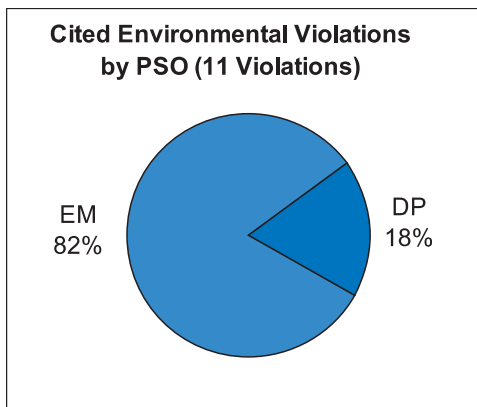
Violations by Statute

- Violations in the 97Q3 were dominated by a NOV at INEEL, citing 135 violations of RCRA. Savannah River Site also received a NOV for multiple RCRA violations. Both violations included substantial fines. Violations in 97Q4 are represented in this chart.



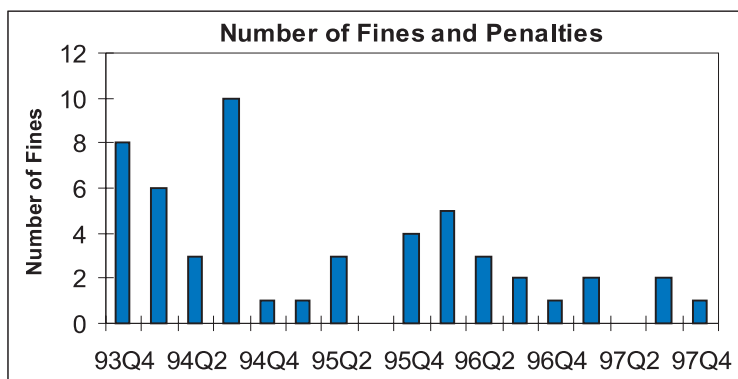
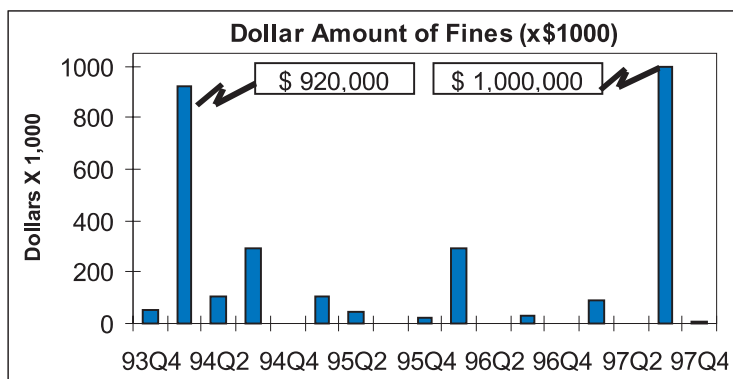
Violations by Program Office

- In 97Q3, EM accounted for 64 percent of the NOVs, and 96 percent of the violations.
- In 97Q4, EM accounted for 60 percent of the NOVs, and 82 percent of the violations as shown in this chart.
- Since 95Q4, EM has had 304 or 83 percent of the total reported violations (365).



Amount of Fines and Number of Fines

- Two large fines were assessed in 97Q3 for RCRA violations at Idaho and Savannah River. In 97Q4, a Clean Water Act fine (\$7,000) was assessed at the Y-12 plant in Oak Ridge.



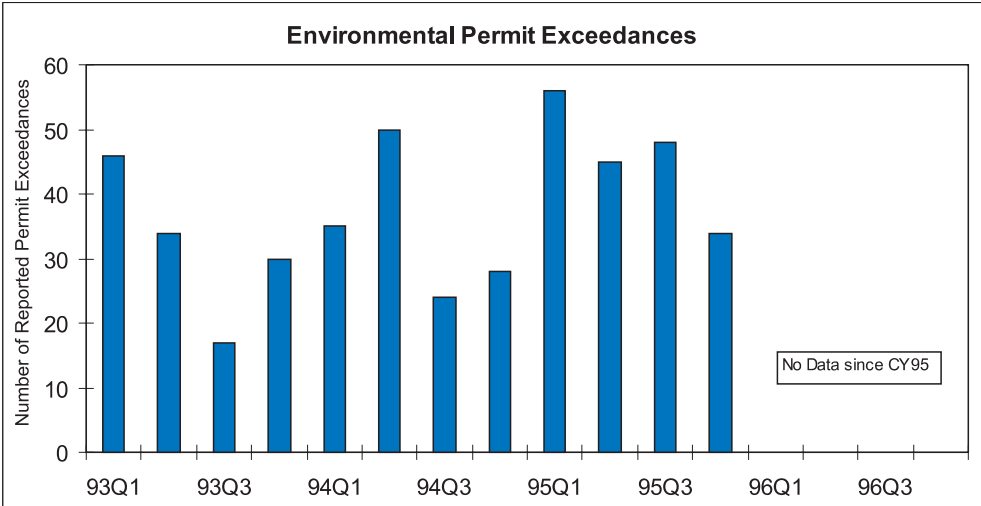
Indicator

8. Environmental Permit Exceedances

Definition

Exceedance of release levels specified in air and water permits during the quarter.

No change to this section since last report.



Source: Annual Site Environmental Reports, additional site data.

Key Observations

- The number of permit exceedances increased each year from 1993 through 1995.
- In 1995, as in previous years, the great majority (94 percent) of exceedances were due to violations of permits under the Clean Water Act for discharge to surface waters.
- A few sites accounted for the majority of DOE's permit exceedances. In 1995, six sites accounted for more than half of the permit exceedances. From 1993 through 1995, five facilities accounted for more than half of the permit exceedances.

Additional Analysis

- Most exceedances (94 percent) continued to occur under National or State Pollution Discharge Elimination System Permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc.
- Other permit exceedances occurred under Clean Air Act permits (3 percent) and groundwater discharge permits (3 percent).
- Over the three-year period 1993-1995, five sites accounted for more than half of the exceedances, and nine sites accounted for 70 percent of the exceedances. In 1995, six sites (although not the identical list) accounted for more than half of the permit exceedances.
- Six sites had exceedances in at least 10 of the 12 quarters reported; however, two of these sites showed significantly fewer exceedances than in the previous two years.

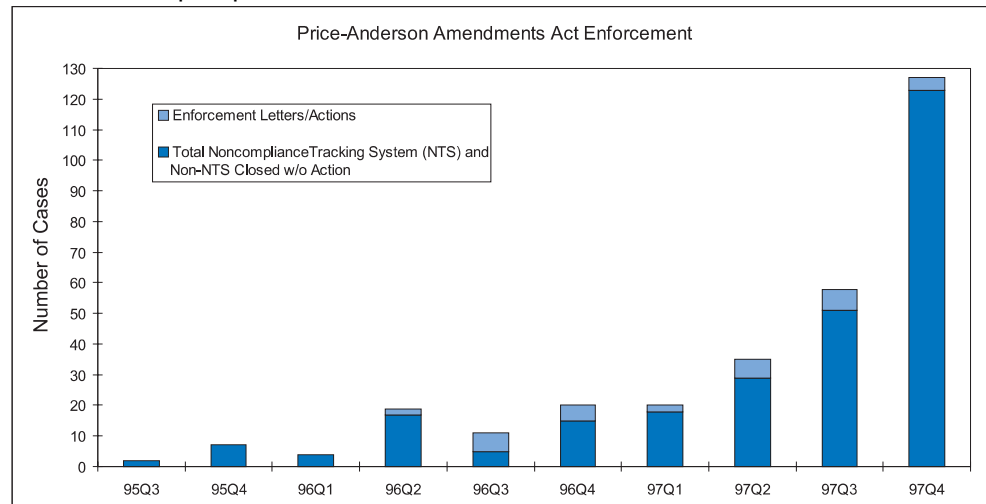
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Indicator

9. Price-Anderson Amendments Act Enforcement

Definition

Total number of cases the Price-Anderson Amendments Act^a (PAAA) Enforcement Office reviews per quarter.



Source: Office of Enforcement and Investigation Database.

Key Observations

- The number of cases the PAAA Enforcement Office reviewed on a quarterly basis continued to increase due to efforts in developing the enforcement program infrastructure which included establishing noncompliance reporting systems, issuing guidance documents, conducting training, and disseminating information.

Additional Analysis

- One Preliminary Notice of Violation (PNOV) without civil penalty was issued in 97Q4. This PNOV was issued to Westinghouse Savannah River Company for deficiencies associated with three safety-grade nitrogen systems placed into operation at the Defense Waste Processing Facility.
- One PNOV issued with a waived civil penalty of \$142,500 was issued in 97Q4 (waived due to statutory exemption for national laboratories). This PNOV was issued to Brookhaven National Laboratory for a number of radiological control deficiencies.
- Two PNOVs issued with civil penalties totalling \$206,250 were issued in 97Q4. The first PNOV, with a civil penalty of \$112,500, was issued to EG&G, Inc. for a number of potential programmatic deficiencies involving the administration of the Mound Plant's bioassay program. The second PNOV, with a civil penalty of \$93,750, was issued to Westinghouse Savannah River Company for an unplanned intake by a worker and numerous instances in which radiological work was not performed in accordance with established procedures, standards, and administrative controls.
- Of the 123 cases reviewed and closed without action by the PAAA Enforcement Office in 97Q4, 28 were self-identified by the responsible contractor via the Noncompliance Tracking System and 95 were identified independently by the PAAA Enforcement Office.

^a 10 CFR Parts 830.120, 835, and 820.11.

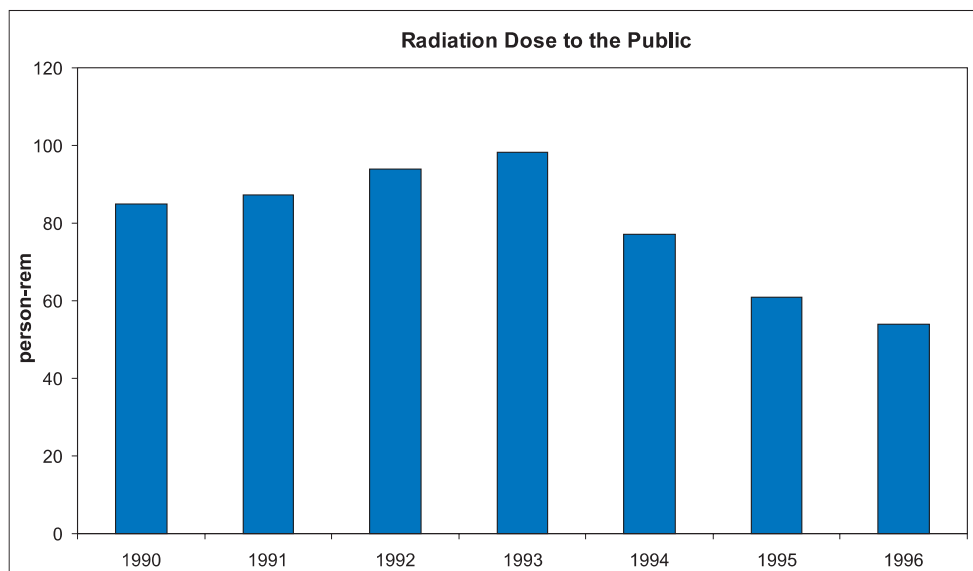
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Indicator

10. Radiation Dose to the Public

Definition

Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)



Source: Annual reports to EPA; EH-41 data tabulation.

Key Observations

- Total collective radiation dose to the public from DOE sources was very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases was one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1996 decreased 12 percent from the previous year. This continued the recent downward trend, attributable to reduced nuclear production activities.

Additional Analysis

- The top five sites in 1996 (in order: Rocky Flats, Oak Ridge, Savannah River, Princeton Plasma Physics Laboratory, and Fernald) accounted for about 72 percent of the total dose.
- The dose from Rocky Flats increased from negligible in 1995 to 10.5 person-rem in 1996 due to decontamination and decommissioning work, particularly excavations at the T-3 and T-4 trenches as part of the site remediation program.
- The dose from Princeton increased from negligible in 1995 to six person-rem in 1996 due to nonroutine upgrades to diagnostic systems which resulted in some additional tritium exhausted to the atmosphere.

- The decrease in collective radiation dose in 1996 reflected decreases in the dose from Lawrence Berkeley, Lawrence Livermore 300 Area, and Argonne-East; in 1995 they accounted for 42 percent of the dose; and in 1996 less than 7 percent. While the graph on the previous page reflects this overall decrease in collective radiation dose in 1996, there were large increases in 1996 at Rocky Flats and Princeton.

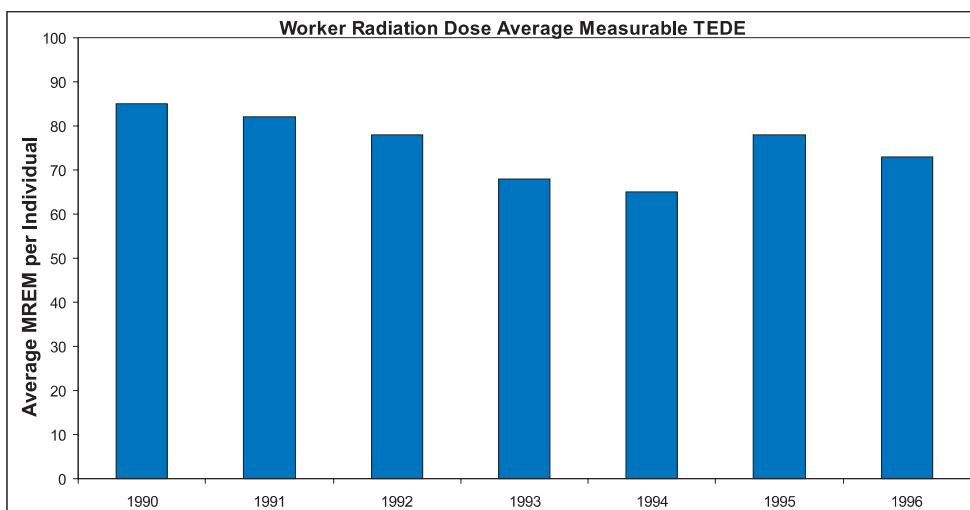
Indicator

11. Worker Radiation Dose

Definition

Average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed work force size.



Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1996, DOE/EH-52, U.S. Department of Energy.

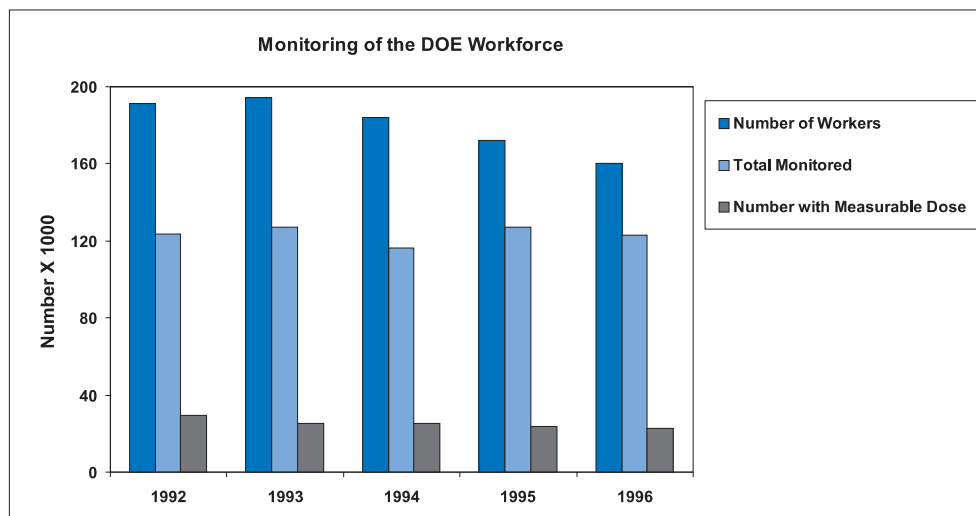
Key Observations

- Between 1995 and 1996, the DOE collective total effective dose equivalent (TEDE) decreased by 10 percent due to decreased doses at 5 of the 7 dose sites with the highest radiation dose. In addition, the average dose to workers with measurable dose decreased by six percent, the number of individuals receiving measurable dose dropped by four percent, and there was one exposure over the DOE five rem TEDE limit.

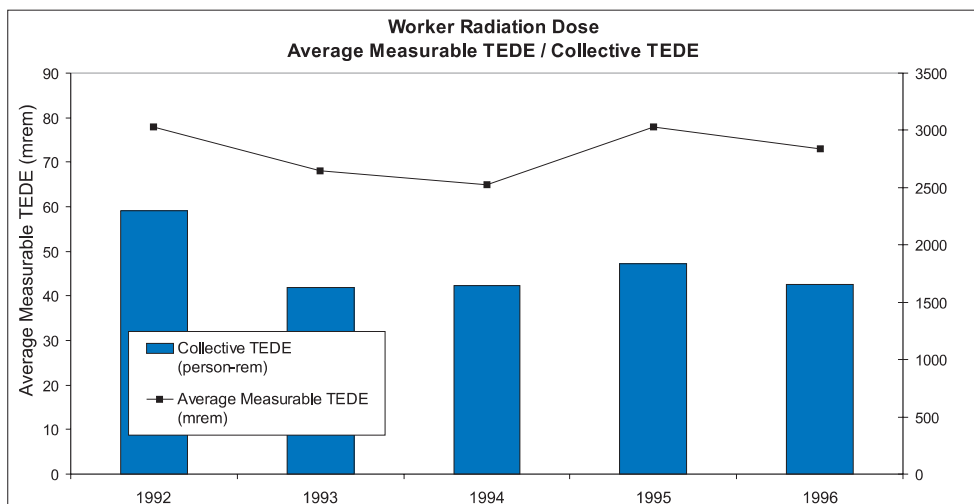
Additional Analysis

- Additional information concerning exposure received by individuals associated with DOE activities is included in the DOE Occupational Radiation Exposure Report 1996 DOE/EH-0564 (on line at <http://rem.s.eh.doe.gov/annual.htm>).

DOE Doses



- The above chart shows the total number of workers at DOE, the total number monitored, and the number with measurable dose for the past 5 years. The percentage of the DOE workforce monitored for radiation exposure has increased by 12 percent from 1992 to 1996. However, most of the monitored individuals do not receive any measurable radiation dose. Only 20 percent of monitored individuals (14 percent of the DOE workforce) received a measurable dose during the past 5 years.
- Nearly 81 percent of the collective TEDE for the DOE Complex was accrued at 7 DOE sites in 1996. These 7 sites were (in descending order of collective dose) Rocky Flats, Hanford, Savannah River, Los Alamos, Idaho, Brookhaven, and Oak Ridge. Weapons fabrication and testing facilities accounted for the highest collective dose. It should be noted that Rocky Flats and Savannah River accounted for the majority of this dose. These sites were primarily involved in nuclear materials stabilization and waste management, but reported under this facility type. For the past four years, technicians received the highest collective dose of any specified labor category.
- The following chart shows the collective TEDE (the sum of the TEDE received by all monitored individuals) for 1992 through 1996.

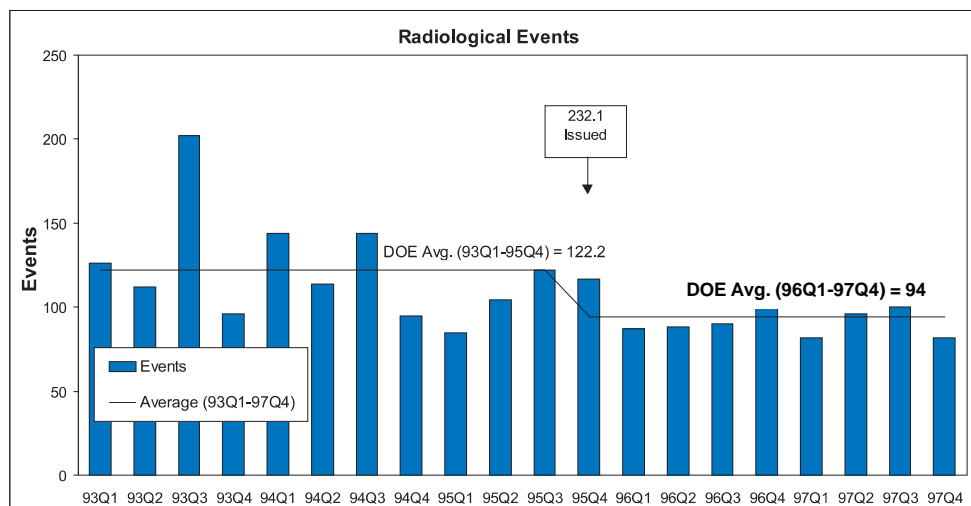


Indicator

12. Radiological Events

Definition

Number of reportable radiological events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. These events are made up of both personnel contaminations and radiation exposures which are reported as personnel radiation protection events.



Source: Review of Occurrence Reports by Department Analysts.

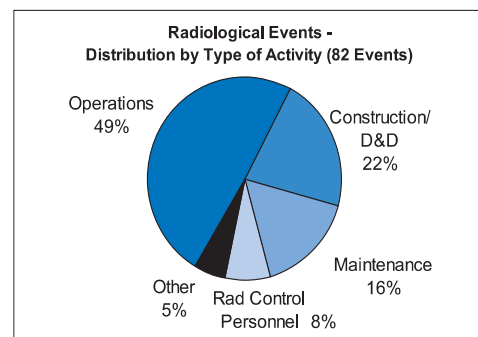
Key Observations

- The number of radiological events reported per quarter, since the full implementation of DOE O 232.1 in 96Q1, demonstrated no statistically significant improvement or deterioration in Departmental performance.
- The 82 radiological events reported this quarter represented the fewest events since 93Q1.
- One hundred two individuals were contaminated in the 82 reported radiological events in 97Q4 as compared to 126 individuals contaminated in 100 events in 97Q3.
- There were four confirmed internal contaminations in 97Q4. This represented a significant reduction compared to the previous three quarters in which there were an average of nine confirmed internal contaminations reported per quarter.

Additional Analysis

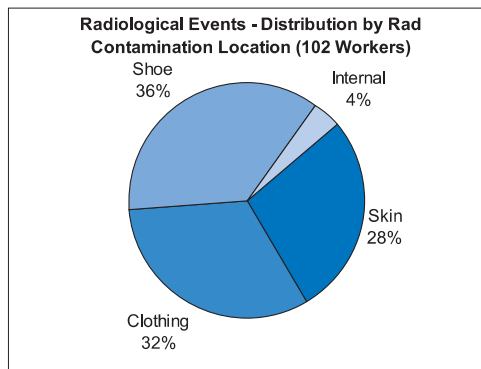
Distribution by Activity

- The radiological events reported in 97Q4 were analyzed as to the type of activity that was taking place at the time of the contamination. This chart represents this analysis.
- The distribution of events by type of activity was consistent with that observed in previous quarters.

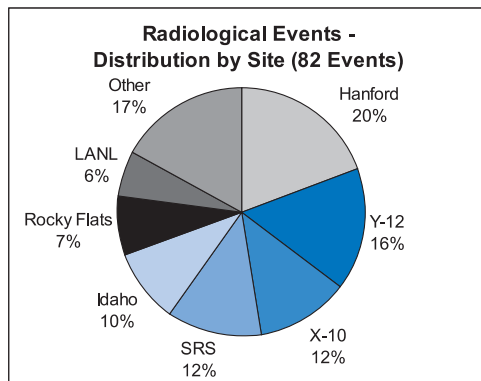


Distribution by Radioactive Contamination Location

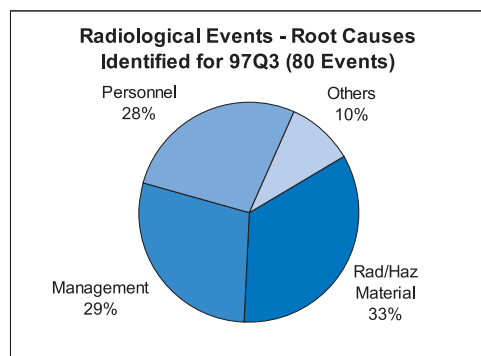
- The events reported in 97Q4 were analyzed as to the location on the individual where the contamination occurred. This chart represents this analysis.
- Twenty-six of the 82 radiological events reported the specific isotope involved in the contamination(s). Of these, seven involved Cesium 137, six involved Plutonium 238/239, and five involved Strontium 90.

**Distribution by Site**

- This chart represents the distribution of radiological events for 97Q4 by site.
- The reduction in the number of radiological events reported this quarter (82) when compared to 97Q3 (100) was attributed to the reduced number of events reported at facilities managed by Albuquerque, Chicago, and Savannah River.

**Distribution by Root Cause**

- Of the 100 radiological events reported in 97Q3, 80 had root causes identified. This chart represents the distribution of these radiological events by root cause.

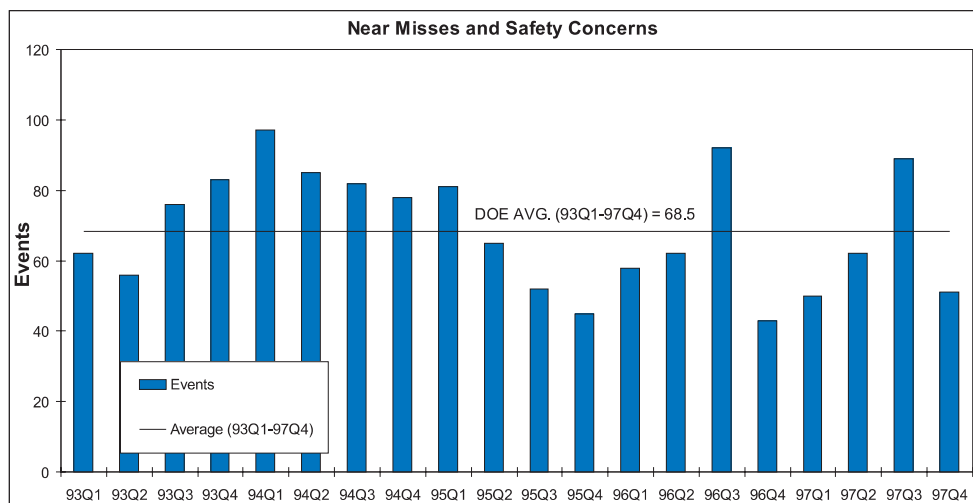


Indicator

13. Near Misses and Safety Concerns

Definition

Operational events where barriers to an accident have been compromised such that no barriers or only one barrier remain (e.g., lack of fall protection, electric shock without injury, unauthorized confined space entry). A safety concern includes: the unauthorized use of hazardous products or processes, or when work is shut down as a result of an OSHA violation. Near misses and safety concerns are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department Analysts.

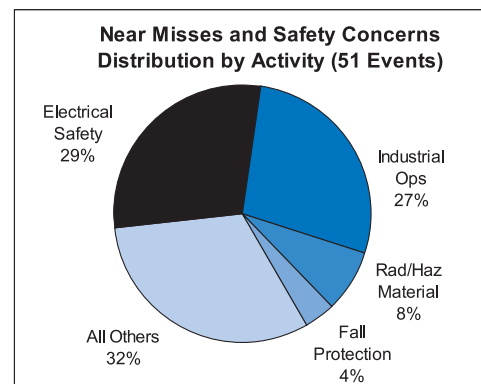
Key Observations

- In 97Q4, DOE reported a total of 51 near misses and safety concerns events—a significant decrease from the 89 events reported in 97Q3.

Additional Analysis

Distribution by Activity

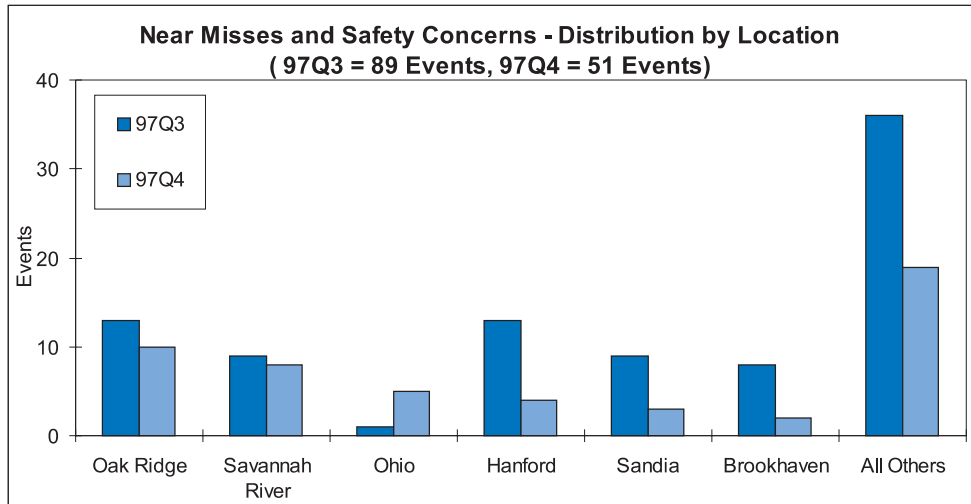
- A detailed breakdown of near misses and safety concerns events for 97Q4 distributed by type of activity is shown in this chart.
- Electrical safety and industrial operations contributed the majority (56 percent) of the near misses and safety concerns events. They also contributed four of the five near miss-related injuries during the quarter.



Distribution by Location

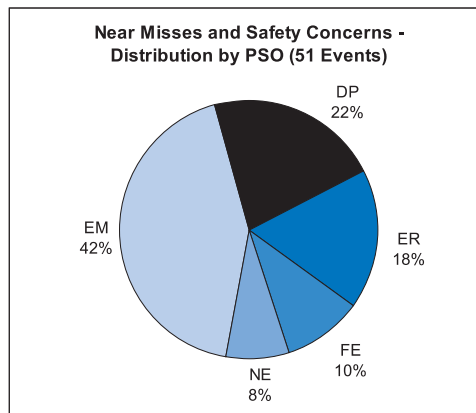
The distribution by location is shown below.

- While Hanford, Sandia, and Brookhaven reported significantly-reduced near misses and safety concerns events in 97Q4, Ohio increased its reportable events from one in 97Q3 to five in 97Q4.



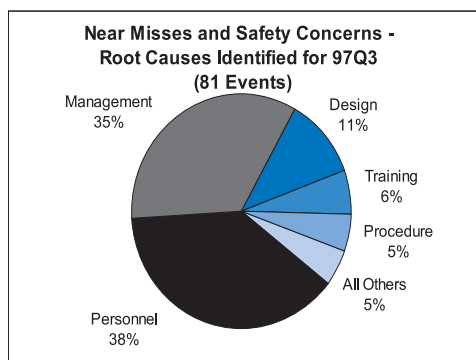
Distribution by Program Secretarial Office (PSO)

This chart shows the distribution of near misses and safety concerns by PSO for 97Q4.



Distribution by Root Cause

- Eighty-one root causes were identified in 97Q3 for near misses and safety concerns events. They are distributed as follows:

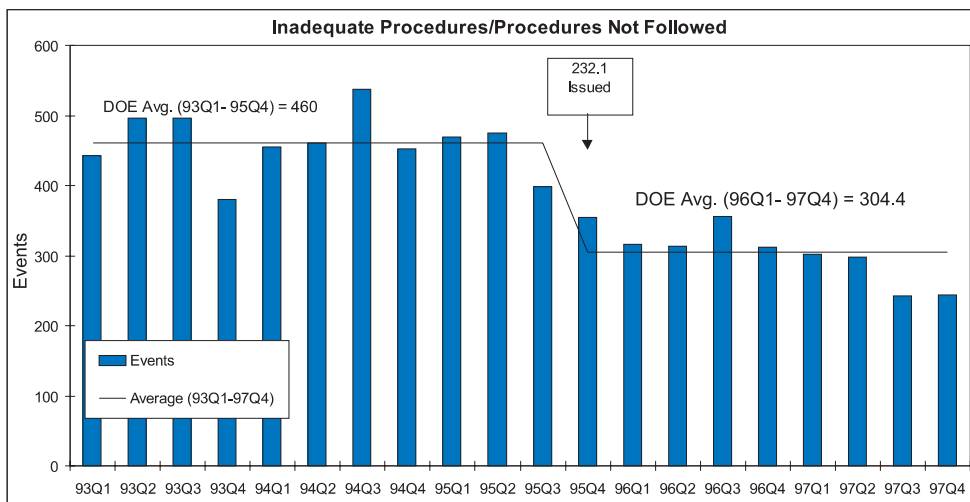


Indicator

14. Inadequate Procedures/Procedures Not Followed

Definition

Number of reportable events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure violations or problems, or which are reported as being caused by a procedure violation or problem.



Source: Review of Occurrence Reports by Department Analysts.

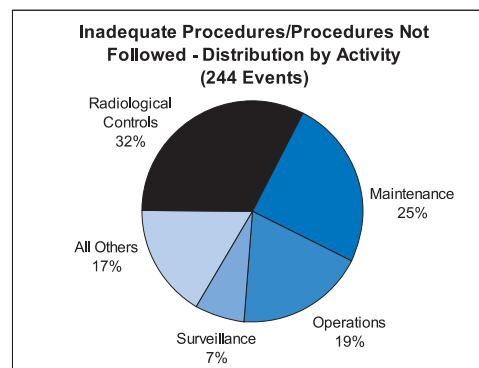
Key Observations

- A decreasing trend existed since 93Q1. This trend was especially apparent since 94Q4.
- The number of events involving procedure violations or inadequacies in 97Q4 (244) remained essentially constant when compared to the number of events reported in 97Q3 (243).

Additional Analysis

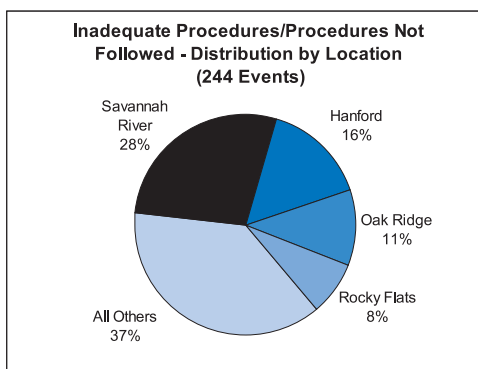
Distribution by Activity

- The major types of activities taking place at the time the procedural problems occurred during 97Q4 are represented in this chart.
- Of the radiological controls-related activities, the largest contributors were material handling activities and conduct of radiological work violations.
- Other significant contributors included activities related to maintenance tasks and operations-related procedure violations.



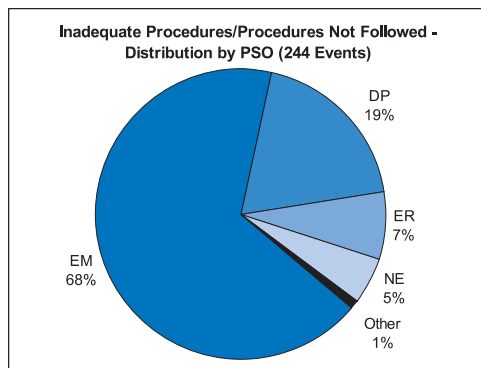
Distribution by Location

- This chart represents a distribution of the five major contributors for 97Q4.
- These same sites have been among the top contributors since 93Q1.
- Savannah River continued as the leading contributor since 97Q1. The number of events at this site rose every quarter from 41 in 97Q1 to 68 in 97Q4, a 65 percent increase for the year.
- The leading contributors to the procedural violations at Savannah River appeared to be related to radiological control activities (23) and maintenance activities (22).
- Savannah River management attributed the rise in procedure violations to the increase in decontamination and decommissioning (D&D) activities at the site.
- Hanford was the second leading contributor. The majority (47 percent) of procedural-related events at Hanford were related to either radiological work or the storage and handling of radioactive material.



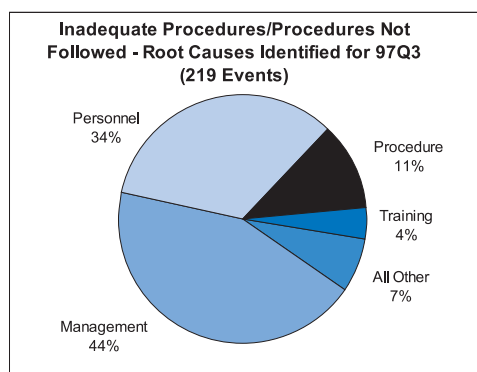
Distribution by PSO

- This chart represents a distribution of the number of Inadequate Procedures/Procedures Not Followed events by Program Secretarial Office (PSO) for 97Q4.



Distribution by Root Cause

- This chart represents a distribution of the number of Inadequate Procedures/Procedures Not Followed events by root cause for 97Q3.
- As has been the case since 93Q1, for those events with root causes identified, the top 3 cited root cause categories were management (96 events), personnel (74 events), and procedure (25 events).
- Of the personnel errors cited, Inattention to Detail and Procedures Not Used or Used Incorrectly were the top two contributors. This is consistent with 97Q2.
- The top two management causes cited were Inadequate Administrative Controls and Policies Not Adequately Defined, Disseminated, or Enforced.
- Defective or Inadequate Procedure was the major procedural root cause identified.



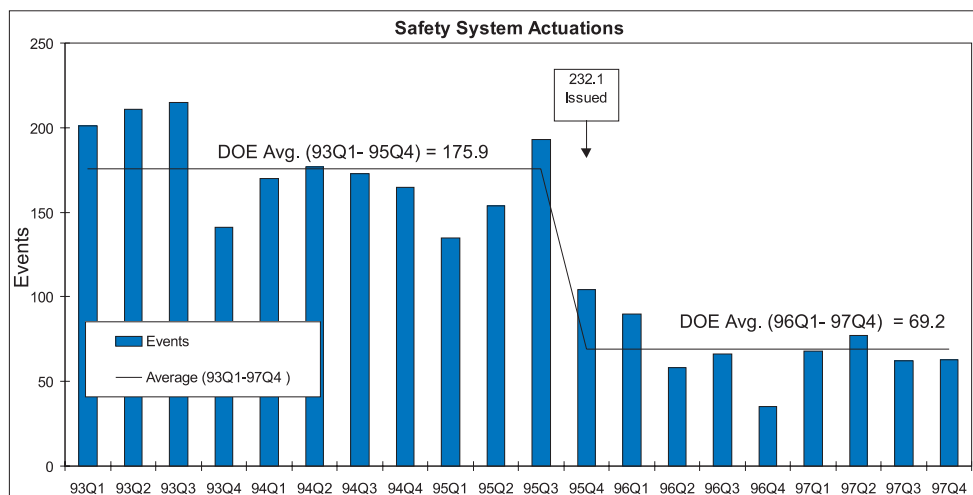
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Indicator

15. Safety System Actuations

Definition

Number of operations-related events determined to be safety system actuations reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. This includes real actuations of any safety-class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruptions of facility activity related to weather phenomena, facility evacuations, or losses of process ventilation. These events have the potential to impact the safety and health of workers in the vicinity.



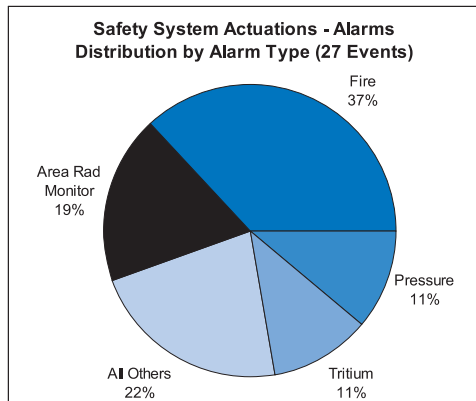
Source: Review of Occurrence Reports by Department Analysts.

Key Observations

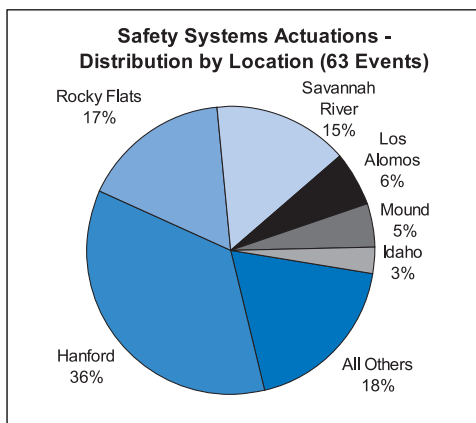
- Since the full implementation of DOE O 232.1 in 1996Q1, safety system actuations averaged 65 per quarter. The average for calendar year 1997 was 67 safety system actuations per quarter.
- Of the 63 safety system actuations in 1997Q4, 25 involved the loss of process ventilation. Of these 25 events, 10 were due to unexpected and unplanned ventilation system shutdowns during maintenance activities, 6 were the result of equipment failure, 5 were the result of facility loss of power, and 4 were due to other causes. Facilities at the Hanford site accounted for 13 of the 25 ventilation system failures. Hanford site personnel are aware of the significant increase in ventilation-related failures in 1997Q4 and corrective actions have been initiated. During calendar year 1997, the Operating Experience Weekly Summary documented five events that involved the loss of process ventilation with lack of proper work planning noted in three of the events.

Distribution by Alarm Type

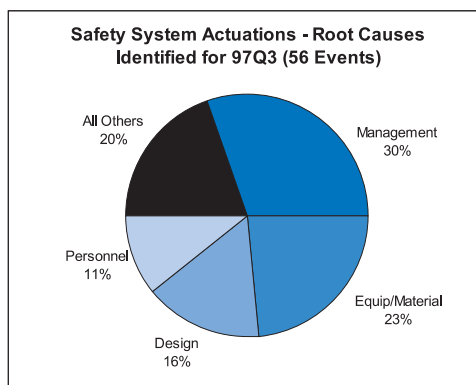
- Of the 63 safety system actuations reported in 97Q4, 27 involved the non-spurious actuation of alarms. The following chart represents the distribution of these alarms by the alarm type.
- System failures also constituted a portion of the safety system actuations reported in 97Q4. The two primary contributors were process ventilation failures (25) and electrical system failures (9).
- Weather phenomenon was a factor in five of the reported safety system actuations in 97Q4.

**Additional Analysis****Distribution by Location**

- The safety system actuation events reported in 97Q4 were analyzed as to the location where the actuation occurred. This chart represents this analysis.
- The Hanford site reported the most safety system actuations (23) in 97Q4. The 23 events reported by Hanford were twice the quarterly average over the previous four quarters (11).

**Distribution by Root Cause**

- This chart represents the distribution of safety system actuation events for 97Q3 by root cause for those events in which a root cause had been identified.



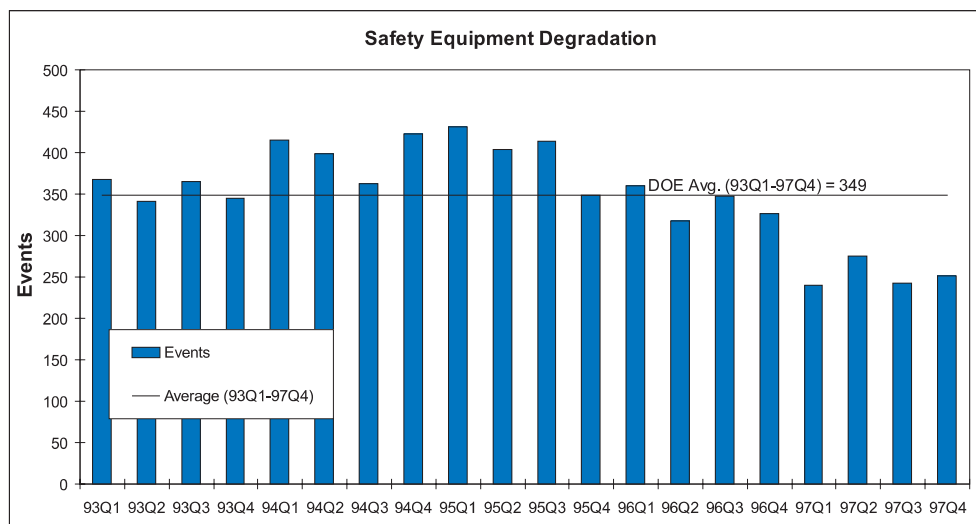
Indicator

16. Safety Equipment Degradation

Definition

Number of reportable events categorized as “vital system/component degradation” as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillances/inspections and appraisal findings of any safety SSC.



Source: Review of Occurrence Reports by Department Analysts.

Key Observations

- In 97Q4 the number of safety equipment degradation events remained relatively constant with 97Q3 (from 243 events in 97Q3 to 251 events in 97Q4).
- The total of 251 events for 97Q4 is significantly lower by 39 percent than the average of 349 for the last 20 quarters.

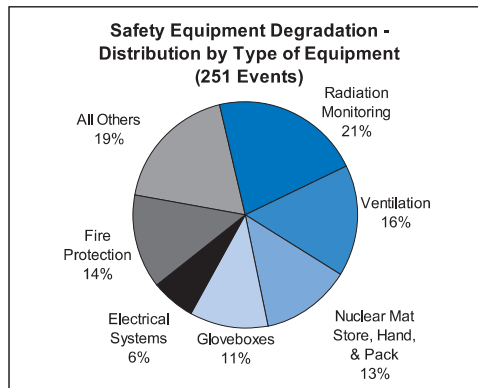
Additional Analysis

Distribution by Type of Equipment

The chart on the following page represents a distribution by type of equipment for 97Q4:

- As has been the case in the last several quarters, radiation monitoring equipment and ventilation equipment were the two major contributors to safety equipment degradation in 97Q4. Fire protection equipment, nuclear material handling equipment, and gloveboxes also were significant contributors last quarter.
- For radiation monitoring equipment (21 percent of the total degradations found in 97Q4), the leading type of equipment suffering degradation was the Continuous Air Monitor (CAM). This equipment contributed to 30 percent of the total.

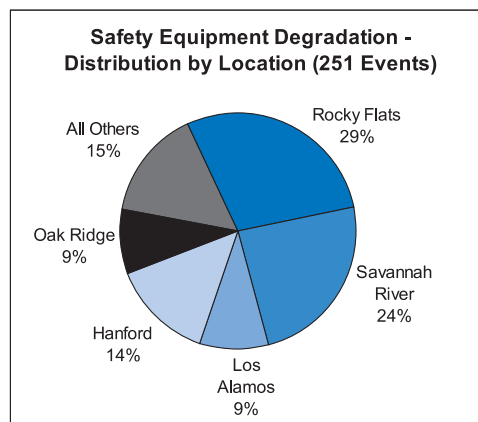
- For ventilation equipment (16 percent of the total in 97Q4), the single largest contributor (80 percent) was degraded fans. The Pressure Differential Indicating Controller (PDIC) was the second most frequently cited type of degraded ventilation equipment at 18 percent.



Distribution by Location

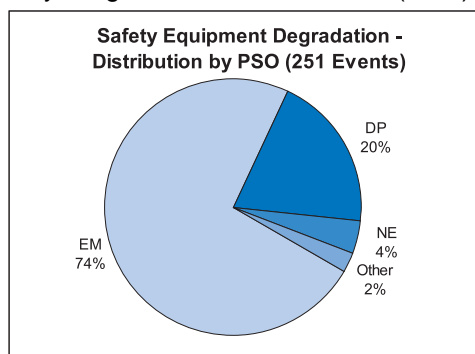
This chart represents a distribution of the five major contributors for 97Q4:

- There was a significant decrease during this quarter in the number of safety equipment degradation events (3) at Pantex from the last several quarters: 43 in 97Q1, 24 in 97Q2, and 33 in 97Q3.
- According to Pantex site personnel, there were two reasons for this sharp decrease in the number of safety equipment degradation events. In 1997, Pantex began applying documented corrective action measures to address concerns. Secondly, there was a change in definition for the threshold of a reportable event. If one could take the actions associated with the conditions as stated in the Critical Safety Systems Manual, then the issue was not defined as a reportable event. If not, then the issue was a reportable event.
- Rocky Flats and Savannah River continued as the leading two contributors. Rocky Flats had 71 events in 97Q3 and 73 events in 97Q4. Savannah River experienced 61 events in 97Q3 and 60 events in 97Q4.
- Hanford reported an increase from 17 events in 97Q3 to 35 events in 97Q4, largely due to an increase in events dealing with non-radiation hazardous materials equipment, radiation monitoring equipment, and fire protection equipment. Hanford site personnel attributed this increase to aging equipment at the tank farms (some materials are 40-50 years old) and an increase in decontamination and decommissioning (D&D) activities.



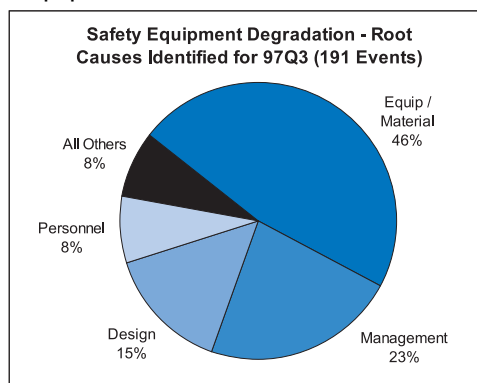
Distribution by PSO

- This graph represents the distribution of the number of safety equipment degradation events by Program Secretarial Offices (PSO) for 97Q4.

**Distribution by Root Cause**

The following chart represents a distribution of the four major root causes:

- Of the 243 events reported in 97Q3, 191 (or 79 percent) had established root causes at the time that the analysis was performed.
- The root cause for 90 of the events was an equipment/material problem. Of these, the two most significant sub-categories of root cause were Defective or Failed Part (62 events) and End of Life Failure (18 events).
- The distribution by root cause was similar to 97Q2 in that 78 events out of 242 were attributed to equipment/material problems. However, 27 of the 242 events were attributed to a management problem, specifically Inadequate Administrative Control, and 23 of the 242 events were attributed to a design problem, specifically Error in Equipment or Material Selection.



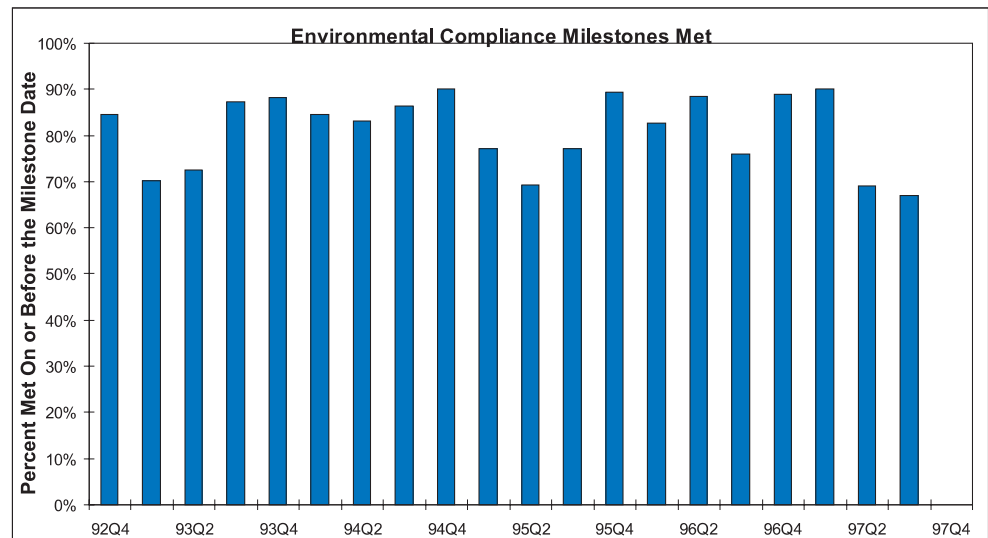
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Indicator

17. Environmental Compliance Milestones Met

Definition

Enforceable requirements in environmental agreements met on or before the milestone date (percent).



Source: Progress Tracking System Data, Office of Environmental Management, EH-41.

Key Observations

- DOE met only 67 percent of its enforceable milestones in 97Q3. This was the lowest performance since 92Q4.
- In FY97, DOE met only 78 percent of its enforceable milestones. By comparison, in FY96, DOE met 83 percent of its milestones.

Additional Analysis

- Data for 97Q4 were not available from the Office of Environmental Management at press time.
- At the end of 97Q2, DOE projected it would meet 78 percent of its milestones in 97Q3. Actual performance was 69 percent of 97Q3 milestones.
- Revised data from 96Q4 and 97Q1 show slightly improved performance for those quarters over that reported in the June 1997 Performance Indicators Report (from 81 percent to 89 percent and from 85 percent to 90 percent, respectively).
- Final numbers show that 345 milestones were established for completion in FY97 and 498 in FY96. Of the FY97 milestones, over 30 percent had goal dates set in the third quarter. Both DOE and the regulator set milestones by the fiscal year; thus milestones tend to peak in the third quarter. This trend was observed for the last five fiscal years.
- These data do not capture all enforceable milestones. They reflect only those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85-90 percent of all DOE enforceable environmental milestones.

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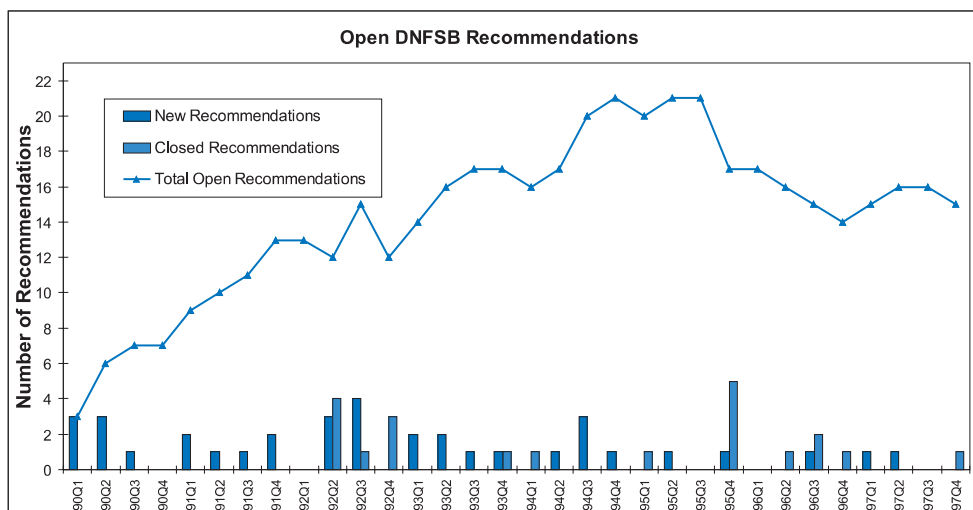
Indicator

18. Open DNFSB Recommendations

Definition

Cumulative numbers of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities involved in nuclear safety issues.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System (SIMS).

Key Observations

- As of December 1997, there were 15 open DNFSB recommendations representing 626 DOE commitments. A total of 61 percent of the commitments were fulfilled and 11 percent were overdue. Of the overdue commitments, 64 percent were overdue by 3 months or longer. Recommendation 93-2 (Criticality Experiments Capability) was closed in December 1997 with the issuance of the 97-2 Implementation Plan for Continuation of Criticality Safety.
- The 97-2 Implementation Plan added 30 new commitments, and the 92-4 Implementation Plan revision, issued in October, reduced the total number of commitments by 44. A total of 21 commitments were completed over the past quarter.

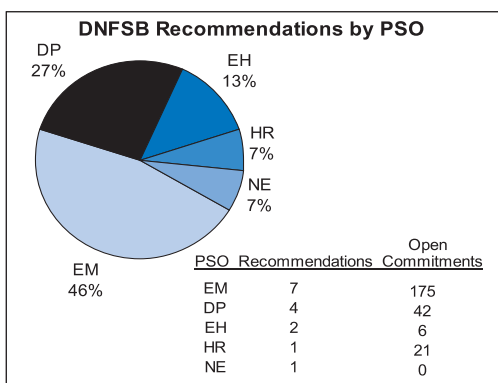
Additional Analysis

- Environmental Management (EM) and Defense Programs (DP) continue to have responsibility for implementing most of the recommendations. Of the 626 commitments, EM and DP have 85 percent of the total and 75 percent of the open commitments.

- As of December 1997, 45 of the 67 overdue commitments were associated with three Implementation Plans, all of which are under revision: 93-3 (Improving Technical Capability), 94-1 (Improving Schedule for Remediation), and 96-1 (In-Tank Precipitation System). The 93-3 Implementation Plan revision was drafted with approval expected in the second quarter of 1998.
- Two recommendations have 100 percent of the associated commitments complete: 93-6 (Maintaining Access to Nuclear Weapons Expertise) and 95-1 (Cylinders Containing Depleted Uranium).

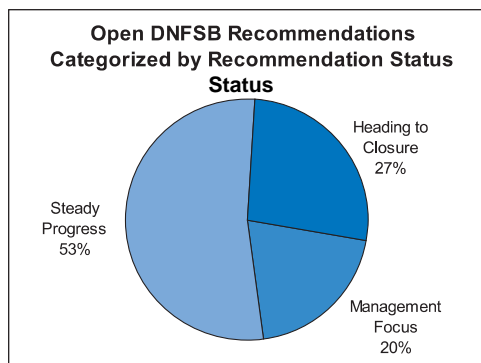
Distribution of Open Commitments

- The trend continued over this quarter (97Q4) in the increasing number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans). At the end of June 1997, there were 217 open commitments, September 1997 ended with 228 open commitments, and December 1997 ended with 244 open commitments. The Office of Environmental Management (EM) has a total of 394 commitments of which 175 (44 percent) remain open. Of the total DOE open commitments (244), EM has the largest number, accounting for more than 70 percent. This chart reports the recommendations by Program Secretarial Office (PSO).



Characterization of Recommendation Status

- The graph shows an evaluation by the Office of the Department's Representative to the DNFSB (S-3.1) on the number of open DNFSB recommendations categorized by recommendation status for 97Q4. A status of "Heading to Closure" includes the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. "Steady Progress" implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (eight) of overdue commitments.



- One new recommendation was added to the Management Focus list: Rec. 96-1 (In-Tank Precipitation System) due to the number of overdue commitments. Eight or more Implementation Plan commitments are overdue for each of the following: Rec. 93-3, Rec. 94-1, and Rec. 96-1.
- During 97Q4, two recommendations were removed from the Management Focus list: Rec. 97-2 (Continuation of Criticality Safety)—the Department's implementation plan was completed in December 1997, and Rec. 92-4 (Hanford Multi-Function Waste Tank Facility)—the Department's revised implementation plan was completed in October 1997.

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Indicator

19. Enhanced Work Planning Implementation

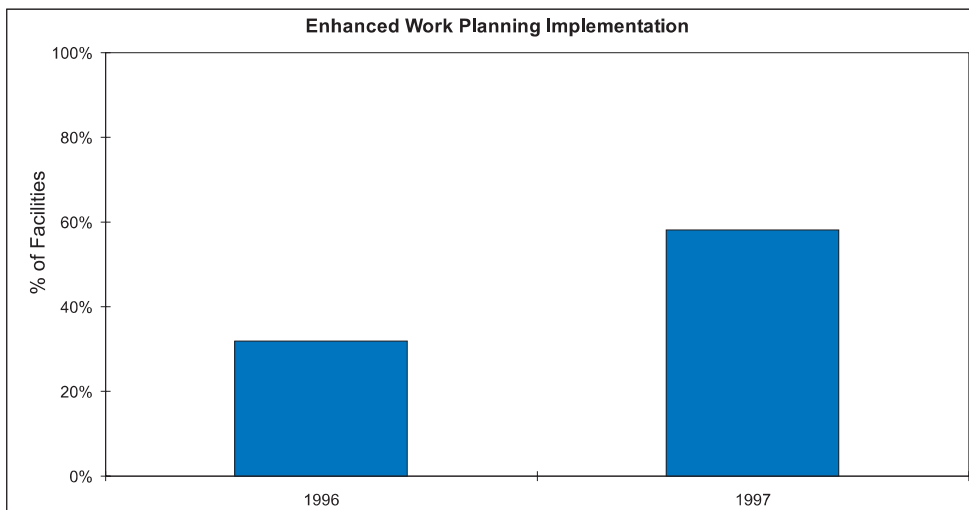
Definition

Number of facilities that have implemented Enhanced Work Planning (EWP) divided by the total number of facilities throughout the DOE Complex.

Enhanced Work Planning is a process that evaluates and improves the program by which work is identified, planned, approved, controlled, and executed. The key elements of Enhanced Work Planning are line management ownership, a graded approach to work management based on risk and complexity, worker involvement beginning at the earliest phases of work management, organizationally diverse teams, and organized, institutionalized communication.

For the purpose of this indicator, a facility is defined as a DOE building as described in the DOE Office of Oversight's Site Profiles. This list was further supplemented with additional facilities not covered in the Site Profiles, such as the AMES and Fermi Laboratories as well as DOE's petroleum reserves among others.

The Enhanced Work Planning Successes information provided for this PI Report is located on the Internet at: (<http://tis-nt.eh.doe.gov/WPPH/ewp/success.htm>), is maintained by the Office of Worker Health and Safety, and has been used as a source directly from the homepage. You can find greater details and additional information on the DOE Worker Protection Programs and Hazards Management homepage on the Internet at: (<http://tis-nt.eh.doe.gov/WPPHM/>). EH-53 was responsible for the validation and verification of the data contained therein.



Source: Office of Field Support (EH-53).

Key Observations

EWP implementation efforts at eight different DOE sites continued to reap substantial gains for the Department. The following are some examples of accomplishments reported in 97Q2:

- **Safety and Health**

EWP implementation in Tank Farms substantially improved safety and health activities from 1991 to 1995. There has been an almost 40 percent decrease in recordable injuries because of earlier identification and control of hazards, and a 50 percent reduction in the lost/restricted workday case rate (per 200,000 hours worked) at Tank Farms.

In addition, an approximate 50 percent reduction in skin contaminations (per 10,000 radiation zone entries) was accomplished from 1994 to 1995 at Tank Farms.

- **Cost Savings**

Since 1995, the Department had over \$14,000,000 of projected cost avoidance by implementing new integrated scheduling systems, by improving planning process, by increasing efficiency of work package review process, by streamlining documentation preparation, and by proper scheduling of radiological control technicians. These new EWP implementations took place at Idaho Chemical Processing Plant (ICPP), Mound, Oak Ridge, Hanford, and Fernald.

- **Streamlined Process**

Between 1995 and 1996 the Department has dramatically streamlined processes at the following sites:

- Mound had a 30 percent reduction in time to complete requested maintenance service.
- Oak Ridge experienced a 20 percent savings by reducing delays in the field.
- Oak Ridge had a 50 percent reduction in work planning time.
- PUREX experienced a five-fold reduction in the number of jobs requiring detailed plans due to simplified work planning and a newly developed job hazard analysis computer program.
- PUREX also experienced a 10-fold reduction in the number of packages requiring multiple (as many as 14) approvals.

Indicator

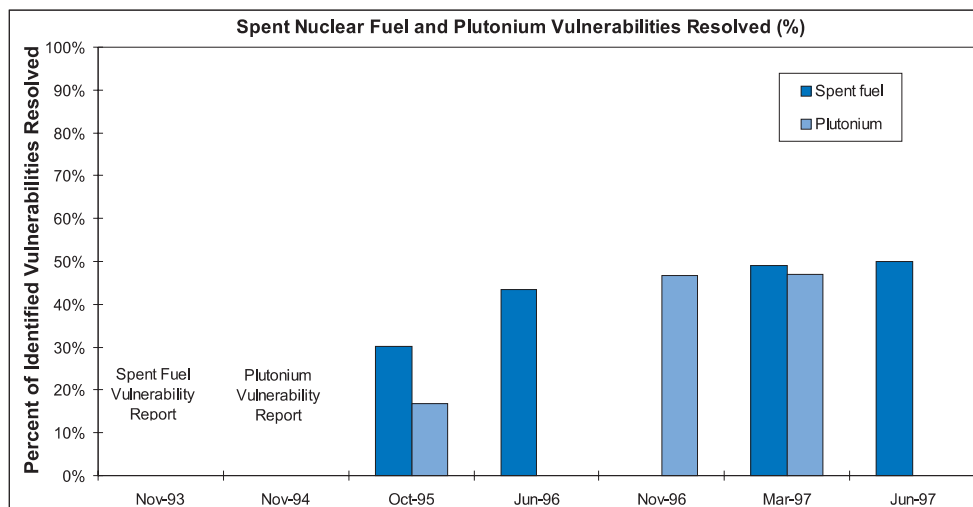
20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition

Number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel...and Their Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

No change to this section since last report.

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure to the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.



Source: *Draft Plutonium Vulnerability Management Summary Report, June 1997 (EM-66)*.
Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, June 1997 (EM-67).

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- As of 97Q1, 47 percent of the identified plutonium vulnerabilities have been resolved.
- As of 97Q2, 50 percent of the identified spent fuel vulnerabilities have been resolved.

- The most spent nuclear fuel vulnerabilities (34 percent) were identified at Hanford, which maintains 80 percent of the DOE total spent nuclear fuel inventory by weight.
- There were 524 identified corrective actions for the 106 spent nuclear fuel vulnerabilities. Of these 524 corrective actions, 382 (73 percent) have been completed. Only one of the open corrective actions was overdue.
- The following table (Table 1) indicates the breakdown of spent nuclear fuel vulnerabilities as of 97Q2 by location and the progress in resolving the identified vulnerabilities.

Table 1

Spent Nuclear Fuel Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Hanford	36	21	58%
Idaho	33	5	15%
Savannah River	21	17	81%
All Others	16	10	63%
Total	106	53	50%

- The most plutonium vulnerabilities (87) were identified at Rocky Flats, which maintains 80 percent of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 15 have been eliminated and an additional 18 have had the risk reduced to an acceptable level.
- Los Alamos had similar results in closing plutonium vulnerabilities with 14 vulnerabilities eliminated and the risk in 27 other issues reduced to an acceptable level.
- Fifteen of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. Seven of the highest plutonium vulnerabilities were eliminated; the risk for 8 other vulnerabilities has been reduced to an acceptable level.
- The following table (Table 2) indicates the breakdown of plutonium vulnerabilities as of 97Q1 by location and the progress of resolving the identified vulnerabilities.

Table 2

Plutonium Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Rocky Flats	87	33	38%
Los Alamos	60	41	68%
Savannah River	40	10	25%
Hanford	34	9	26%
All Others	78	47	60%
Total	299	140	47%

Vulnerability resolution status has been updated for this report from the Draft Plutonium Working Group dated March 1997.

Additional Analysis

Indicator

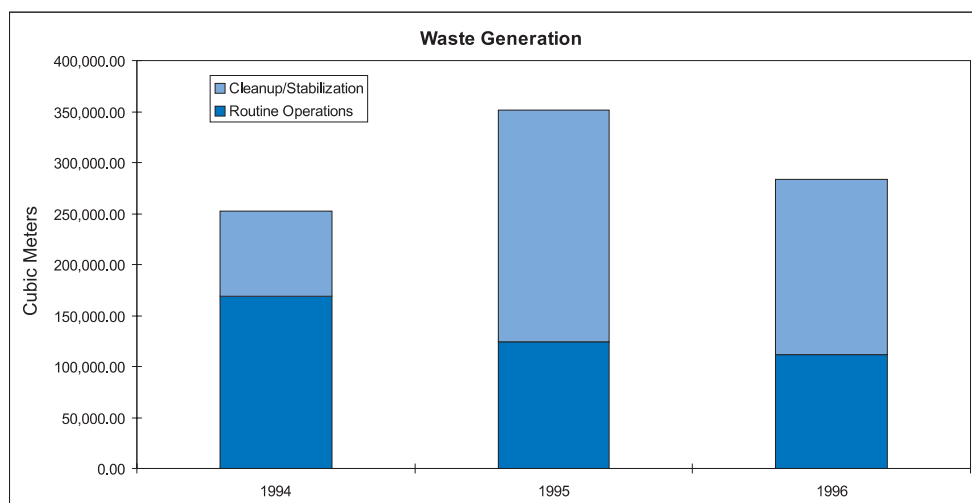
21. Waste Generation

Definition

Total amount of waste generated, in cubic meters, for all DOE sites. Waste types generated include High-Level Radioactive, Transuranic, Low-Level Radioactive, Low-Level Mixed, Hazardous, and Sanitary. These waste types are generated during routine operations or cleanup/stabilization activities.

Routine operations waste consists of normal operation waste produced by any type of production operation; analytical and/or research and development laboratory operations, treatment, storage and disposal operations; "work for others"; or any other periodic or recurring work that is considered ongoing in nature.

Cleanup/stabilization waste, including primary and secondary waste, is generated by the environmental restoration of contaminated media (soil, groundwater, surface water, sediments, etc.), stabilization of nuclear and nonnuclear (chemical) materials, and deactivation and decommissioning of facilities.



Source: *Annual Report of Waste Generation and Pollution Prevention Progress 1996*, August 1997, Office of Pollution Prevention, Office of Environmental Management.

Key Observations

- The overall amount of waste generated decreased from 345,279 cubic meters to 283,948 cubic meters from 1995 to 1996. The amount of waste generated during routine operations (excluding sanitary) decreased 27 percent (from 30,164 cubic meters to 22,544 cubic meters), and the amount of waste generated during cleanup/stabilization operations (excluding sanitary) decreased 15 percent (from 114,201 cubic meters to 97,208 cubic meters). During the same period, the sanitary waste generated during routine operations decreased 9 percent (from 97,797 cubic meters to 89,038 cubic meters), and the amount of sanitary waste generated during cleanup/stabilization operations decreased 27 percent (from 103,117 cubic meters to 75,158 cubic meters).
- According to one of the authors of the *Annual Report of Waste Generation and Pollution Prevention Progress 1996*, the decrease in routine operations waste generated could be attributed to the rigorous pollution prevention programs put in place by programs and operations that reduced the generation of new waste, and the decrease in cleanup/stabilization waste generated for 1996 could be attributed to a peak in funding and phasing of those activities.

- The tables below subcategorize waste generation based on production source: routine or cleanup/stabilization activities.
- From 1995 to 1996, waste generated during routine activities decreased by 10 percent for Transuranic Waste, 27 percent for Low-Level Radioactive Waste, and 25 percent for Hazardous Waste.

Additional Analysis

**Waste Generated During Routine Activities
(Cubic Meters)**

Waste Type	1994	1995	1996
High-Level Radioactive	2,071	2,496	2,670
Transuranic	546	336	302
Low-Level Radioactive	31,868	21,894	15,048
Low-Level Mixed	2,834	1,335	1,371
Hazardous	12,497	4,103	3,153
Sanitary	110,208	97,797	89,038

**Waste Generated During Cleanup/Stabilization Activities
(Cubic Meters)**

Waste Type	1994	1995	1996
Transuranic	214	156	202
Low-Level Radioactive	42,603	86,848	64,968
Low-Level Mixed	14,035	4,518	2,137
Hazardous	8,900	22,679	29,901
Sanitary	16,010	103,117	75,158

- From 1995 to 1996, waste generated during cleanup/stabilization activities decreased 26 percent for Low-Level Radioactive Waste and 52 percent for Low-Level Mixed Waste.
- Sanitary Waste accounted for 42 percent of all waste generated in both 1995 and 1996.

Indicator

22. HEU Vulnerabilities Resolved

Definition

Percentage of vulnerabilities identified in the *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium* (DOE/EH-0525) that have been resolved.

An ES&H vulnerability is defined in the HEU Working Group Report as "conditions or weaknesses that could result in the exposure of workers or the public to radiation, or in releases of radioactive materials to the environment."

This indicator is used to measure the progress in resolving the total of 155 ES&H vulnerabilities found in the assessment, and also specific subsets of these vulnerabilities: 1) the facility and material condition vulnerabilities ranked by the HEU Working Group as being of highest significance, 2) vulnerabilities at specific sites, and 3) vulnerabilities involving U-233.

A significant fraction of the HEU Working Group's assessment involved U-233, stemming from this isotope's particular radiological properties (and those of U-232 co-produced with U-233). The HEU Working Group concluded that a special management plan is needed for safe interim storage of U-233 materials. Thus, U-233 vulnerabilities will be tracked as a separate group, even though this will involve "double counting" of some vulnerabilities ranked as having the highest significance

Key Observations

The following table summarizes the Department-wide status of HEU vulnerability resolution including the subsets of Highest Significance and U-233 Vulnerabilities:

HEU Vulnerability Set	Vulnerabilities Identified	Vulnerabilities Resolved	P.I.= % Resolved
Total, DOE-Wide	155	10	6%
Highest Significance	21	2	10%
U-233 Vulnerabilities	13	2	15%

- As noted in the table above, ten HEU vulnerabilities were resolved in 97Q4 through the DNFSB Recommendation 97-1 Implementation Plan actions.

The following table summarizes vulnerabilities on a site basis for 97Q4. Note that Oak Ridge Y-12 Plant stores a far greater amount of HEU (greater than 189 metric tons) than any other site. Also note that Oak Ridge National Laboratory (ORNL) and Idaho National Environmental Engineering Laboratory (INEEL) have the largest quantities of U-233 as shown in parentheses (424 and 40 kilograms, respectively). Actual inventories of U-233 are classified in cases where exact amounts are not shown.

HEU Site	HEU Inventory*	Vulnerabilities Identified	Vulnerabilities Resolved	P.I.= % Resolved
Oak Ridge Y-12 Plant	>189.0	49	—	—
Rock Flats Env. Tech Site	6.7	28	7	25%
Los Alamos National Lab	3.2 (>1.0)	19	—	—
Portsmouth Gaseous Diffusion Plant	22.0	16	—	—
Idaho Nat. Engineering & Environmental Lab	>1.0 (40.0)	10	1	10%
Savannah River Site	13.8	9	—	—
Oak Ridge K-25 Site	1.5	9	—	—
Oak Ridge National Lab	1.2 (424.0)	6	1	17%
Pantex Plant	16.7**	5	—	—
Sandia National Laboratories	<1.0	1	—	—
Argonne National Lab-West	<10.0	1	1	100%
Lawrence Livermore National Lab	<1.0 (3.1)	1	—	—
New Brunswick Laboratory	<1.0	1	—	—

* Inventory of HEU produced in metric tons and U-233 in kilograms (shown in parentheses).

**Includes planned dismantlement.

Additional Analysis

Led by the Office of Defense Programs (DP), DOE has developed the HEU Vulnerability Management Plan, issued on June 13, 1997 by DP-1, that outlines a process for corrective actions and resolution of the HEU vulnerabilities. DP will track the resolution of the HEU vulnerabilities and report these either by a separate quarterly status report, or by information included in status reports that combine HEU vulnerability resolution with those for plutonium and/or spent nuclear fuel vulnerabilities. Moreover, the HEU Vulnerability Management Plan sets dates for resolution of the rest of the 19 HEU vulnerabilities (two have been resolved) designated by the HEU Working Group as being the highest significance. Thus, tracking of the PIs for these vulnerabilities can be shown against scheduled completion dates.

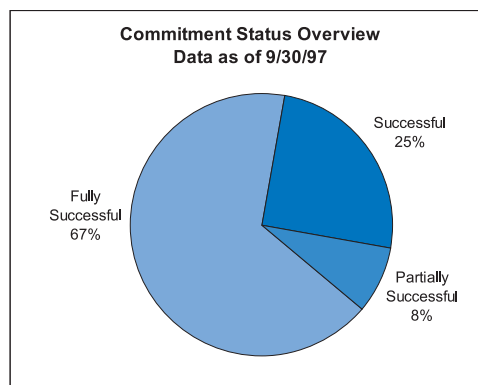
The resolution of the other 126 HEU vulnerabilities identified in the HEU Vulnerability Assessment will depend on site-specific plans. Many of the plans may become part of existing plans for DNFSB Recommendation 94-1. Because of the need to work with separate Field Offices, scheduling and tracking of PIs concerning the other 126 vulnerabilities will take more effort and time to perform than those explicitly covered in the HEU Management Plan.

On March 3, 1997, the DNFSB issued Recommendation 97-1 concerning the safety of U-233. Many of the Board's recommendations reflect findings and conclusions made in the HEU Vulnerability Assessment. The Department submitted the 97-1 Implementation Plan to the DNFSB on September 29, 1997, and it was accepted on October 21, 1997.

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The Secretary's Commitments to the President in EQ and ES&H (for FY97)

Environmental Quality (EQ) and Environment, Safety and Health (ES&H) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1997 are summarized below.



"Commitment Status Overview Data as of 9/30/97"

More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at: <http://www.doe.gov/policy/library/sagree97.html>

Environmental Quality (FY97)

Protected public health and the environment by understanding and reducing the environmental, safety, and health risks and threats from DOE facilities and developed the technologies and institutions required for solving domestic and global environmental problems.

Our Commitments

EQ-1 ACCELERATING RISK REDUCTION AND LIFECYCLE COST REDUCTION OF NUCLEAR WEAPONS SITES CLEANUP

Initiated the implementation of the Environmental Management (EM) Ten-Year Vision to complete the cleanup of most of the Department's contaminated sites over the next 10 years and put in place a responsible waste management, nuclear materials, and surplus facilities stewardship program for the long-term future.(EM)
FULLY SUCCESSFUL

Success was measured by:

- Released the discussion draft of the Environmental Management Progress Plan for Cleanup for public review and comment by June 1997.
- Implemented the EM Integrated Planning, Accountability, and Budgeting System by September 1997.

- Completed the cleanup of the Pinellas Plant, closed it, and turned it over to the Pinellas County by September 1997. This is the first surplus weapons production site to be closed by the Department.
- Accelerated the complete deactivation of the PUREX plant at the Hanford Site from the original schedule of FY 1998 to FY 1997 with an estimated cost reduction of \$43.4 million.
- Continued the development of the privatization strategy to provide alternative methods for accelerating cleanup and reduce cost through competition, private sector financing and the application of proven private sector technology and experience by:
 - Issued request for proposals for contract handled transuranic waste transportation at Carlsbad, New Mexico, by September 1997.
 - Issued request for proposals for the Broad Spectrum Low Activity Mixed Waste Treatment at Oak Ridge Reservation by September 1997.
 - *Issued request for proposals for the Waste Pit Remedial Action at Fernald, Ohio, by January 1997.*

EQ-2 MADE PROGRESS ON THE TREATMENT, STORAGE, AND DISPOSAL OF RADIOACTIVE WASTES

Safely stored radioactive and hazardous wastes and reduced environmental risk by treating and disposing of transuranic, mixed low level, and low level wastes.(EM)

FULLY SUCCESSFUL

Success was measured by:

- *Issued the Final Waste Management Programmatic Environmental Impact Statement by June 1997.*
- *Issued the Final Waste Isolation Pilot Plant (WIPP) Supplemental Environmental Impact Statement by September 1997.*
- *Issued Records of Decision on treatment, storage, and disposal of transuranic waste by September 1997.*
- *Produced at least 270 canisters of vitrified high level waste for future repository disposal.*
- *Treated approximately 6,000 cubic meters of mixed low level waste and disposing of approximately 38,000 cubic meters of low level waste.*
- *Awarded a contract for an advanced mixed waste treatment facility at the Idaho National Engineering Laboratory by December 1996.*

EQ-3 REDUCING THE RISKS; CLEANING UP NUCLEAR WEAPONS SITES

Protected human health and the environment from risks posed by inactive and surplus DOE facilities and contaminated areas.(EM) **FULLY SUCCESSFUL**

Success was measured by:

- *Completed cleanup at 13 EM geographic sites. This brought the cumulative number of completed geographic sites to 65 out of a total universe of 132 geographic sites to be remediated.*

- Completed remedial actions at approximately 400 release sites. This brought the cumulative number of completed release sites to approximately 3,600 out of a total universe of 8,826 release sites.
- Completed approximately 70 facility decommissionings. This brought the cumulative number of completed facility decommissionings to approximately 310 out of a total universe of 1,090 facilities.
- Stabilized approximately 100 Kg of plutonium across EM sites.

EQ-4 FINDING SOLUTIONS TO SPENT NUCLEAR FUEL STORAGE AND FUNDING ISSUES

Refocused the Civilian Radioactive Waste Management Program to provide meaningful deliverables that were consistent with reduced funding and revised policies.(RW) **FULLY SUCCESSFUL**

Success was measured by:

- Completed the excavation of the Exploratory Studies Facility main 5-mile loop and selected scientific instrumentation alcoves to support studies for a viability assessment of the Yucca Mountain site in September 1998 and subsequent site suitability determination and licensing.
- Submitted the Topical Safety Analysis Report to the Nuclear Regulatory Commission for a non-site specific Phase I interim storage facility design to assist in maintaining a readiness capability should interim storage be authorized by legislation.
- Issued a Revised Notice of Proposed Policy and Procedures under Section 180(c) of the Nuclear Waste Policy Act, which provides for technical and financial assistance to States and Indian Tribes for training public safety officials through whose jurisdictions spent nuclear fuel and high-level waste would be transported, in preparation for an orderly transportation activity.
- Issued a draft request for proposals to provide waste acceptance and transportation services and equipment for commercial spent nuclear fuel, to carry on collaboration with the nuclear utilities and other stakeholders to resolve issues, and develop the management and logistical capability in the private sector.

EQ-5 SHUTTING DOWN AND CLEANING UP SURPLUS NON-WEAPONS NUCLEAR REACTOR SITES

Safely deactivated surplus nuclear facilities, including the Experimental Breeder Reactor-II (EBR-II) in Idaho, and prepared wastes for interim storage and ultimate disposition.(NE) **SUCCESSFUL**

Success was measured by:

- Removed the remaining EBR-II fuel (53 assemblies, as of September 1996) from the reactor by December 1996. **FULLY SUCCESSFUL**
- Completed construction of the Sodium Processing Facility at Argonne National Laboratory-West by November 1996. **FULLY SUCCESSFUL**

- Completed the conversion of 30,000 gallons of Fermi reactor sodium, which is currently in storage at Argonne National Laboratory-West, to sodium carbonate by September 1997. **PARTIALLY SUCCESSFUL**

EQ-6 ENSURING ENVIRONMENTAL JUSTICE

Accelerated waste management, environmental cleanup, remediation, and pollution prevention activities in order to address high and adverse impacts of our facilities on the human health and environment of surrounding communities.(ED)
SUCCESSFUL

Success was measured by:

- Completed the construction of the groundwater remediation system for the F&H Area of the Savannah River Site by July 1997. (EM) **FULLY SUCCESSFUL**
- Completed 75 percent of the interim cap construction begun in FY 1996 for the Burial Ground Complex at the Savannah River Site. This project, when complete, will reduce the infiltration of rain and surface water into 76 acres of buried waste site by 70 percent. (EM) **FULLY SUCCESSFUL**
- Completed cleanup activities near the East Fork Poplar Creek community in Oak Ridge. (EM) **FULLY SUCCESSFUL**
- Accelerated remediation of environmental contamination and disposal of wastes at the Portsmouth Site, Oak Ridge Operations. (EM) **FULLY SUCCESSFUL**
- Continued technical training and expanding access of information on subsistence related health risks to affected populations and professionals in medical, scientific and public health, by providing interactive internet-based tools and newsletters. **UNSUCCESSFUL**

EQ-7 PREVENTING FUTURE POLLUTION

Reduced the generation of all waste streams in order to minimize the impact of the Department's operations on the environment, reduce operational cost, and improve the efficiency of its operations. (EM) **FULLY SUCCESSFUL**

Success was measured by:

- Completed pollution prevention plans showing waste reduction goals for 30 reporting sites by September 1997. **FULLY SUCCESSFUL**
- Completed at least 100 pollution prevention projects that reduce/avoid the generation of radioactive and mixed wastes by 4000 cubic meters by September 1997. **FULLY SUCCESSFUL**
- Ensured that 60 percent of DOE purchases of EPA-designated products contain recycled or recovered materials, except where excluded by Section 402(b) of Executive Order 12873. **SUCCESSFUL**

EQ-8 NEGOTIATING INTERNATIONAL SUSTAINABLE DEVELOPMENT AGREEMENTS

Further developing institutions required for solving global environmental problems. (PO) **SUCCESSFUL**

Success was measured by:

- *Had U.S. proposals adopted in the United Nations organizations on climate change, sustainable development, shipment and disposal of hazardous wastes, and long range transport of air pollution.*

SUCCESSFUL

- *Had "joint action plans" in place with at least two countries to promote environmental security interests of the United States.* **SUCCESSFUL**

Environment, Safety, and Health

Continued to shift from a reactive approach to an emphasis on prevention and excellence in protecting worker and public safety and health and in achieving environmental standards. Opened the Department's records related to environment, safety and health and provided stakeholders easy access to this information. **FULLY SUCCESSFUL**

Our Commitments

EH-1 IMPROVING EFFICIENCY AND EFFECTIVENESS OF PROTECTING WORKERS, THE PUBLIC, AND THE ENVIRONMENT

Prevented worker accidents, protected the public and environment, while saving time and resources through safety and health contract provisions and more effective work planning. (EH) **FULLY SUCCESSFUL**

Success was measured by:

- *Incorporated strong and effective safety management systems provisions in four Management and Operation contracts to protect environment, safety, and health.*
- *Implementing Enhanced Work Planning at major DOE sites over the next three years by involving approximately a third of the DOE workers every year in more effective work planning and hazard identification.*

EH-2 IDENTIFYING PRACTICAL WAYS TO ADDRESS THE MOST SIGNIFICANT HEALTH RISKS TO FORMER WORKERS

Surveyed selected former workers and workplace hazards to examine possible links between hazardous substances exposure during work and adverse health effects. (EH) **FULLY SUCCESSFUL**

Success was measured in FY 1997 by completing six assessments, which established the basis for a more comprehensive program of medical follow-up of former workers.

EH-3 PRESERVING AND PROTECTING VALUABLE RUSSIAN RECORDS

Ensured the archival preservation of vulnerable and fragile Russian worker radiation records in the Urals, to help the U.S. gain further insight into radiation safety. (EH) **PARTIALLY SUCCESSFUL**

Success was measured in FY 1997 by completing the preservation microfilming of worker dosimetry records at Mayak. Postponed during FY97 – Currently underway with completion expected in FY 98

EH-4 MAINTAINING A MULTI-DISCIPLINARY INDEPENDENT OVERSIGHT PROCESS

Maintained a multi-disciplinary, fully integrated oversight process for independently evaluating environment, safety, and health, and safeguards and security programs. (EH) **FULLY SUCCESSFUL**

Success was measured in FY 1997 by completing value-added, comprehensive oversight evaluations, focusing on environment, safety, and health-management systems at four DOE sites before October 1997.

Relationship to DOE Strategic Plan Goals

Establish Priorities & Eliminate Hazards

DOE STRATEGIC PLAN (September 1997)

DOE's Four Businesses: Environmental Quality

How we will reduce the environmental, safety, and health risks and threats from DOE facilities and materials, safely and permanently dispose of civilian spent nuclear fuel and defense related radioactive waste, and develop the technologies and institutions required for solving domestic and international environmental problems.

Environmental Quality: Objective 3

Safely and expeditiously dispose of waste generated by nuclear weapons and civilian nuclear research and development programs and make defense high-level radioactive waste disposal-ready

PERFORMANCE INDICATORS

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Chemical Hazard Events
6. Reportable Occurrences of Releases to the Environment
7. Cited Environmental Violations
8. Environmental Permit Exceedances
9. Price-Anderson Amendments Act Enforcement
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events
20. Spent Nuclear Fuel and Plutonium
21. Waste Generation

Performance Requirements

Corporate Management: Environment, Safety, and Health

How we will ensure the safety and health of workers and the public, and protect and restore the environment.

Corporate Management: Objective 1

Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
7. Cited Environmental Violations
8. Environmental Violations
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events
13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations
19. Enhanced Work Planning Implementation

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy's (DOE) Strategic Plan for environment, safety and health is, "how will we ensure the safety and health of workers and the public, and protect and restore the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified in table at the end of this appendix.

Summary of Process

1. Overview

1.1 Initial Performance Measures

2. Data Analysis

2.1 Analyses Performed

2.2 Determining Statistical Significance of Trends

3. Future Plans

B1.1 Initial Performance Indicators

The performance indicators included in this report are identified in the following table. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)*—A system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.
- *Computerized Accident/Incident Reporting System (CAIRS)*—A system for collecting data associated with occupational injury and illness events and statistics.
- *Radiation Exposure Monitoring System (REMS)*—A system for collecting data on individual radiation doses received by DOE complex workers.
- *Environmental Compliance Database*—A system maintained by the Office of Environmental Policy and Assistance.
- *Annual Site Environmental Reports*

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Furthermore, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

PI Component	Data Source
I. Accidents/Events	
1. Lost Workday Case Rate	Computerized Accident/Incident Reporting System/ EH-51
2. Occupational Safety and Health Cost Index	Computerized Accident/Incident Reporting System/ EH-51
3. Electrical Safety	Review of Occurrence Reports, EH-33 Field Office Contacts
4. Industrial Operations Safety	Review of Occurrence Reports, EH-33 Field Office Contacts
5. Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/ Occurrence Reporting and Processing System, EH-52/EH-53/BNL
6. Reportable Occurrences of Releases to the Environment	Review of Occurrence Reports, EH-33
7. Cited Environmental Violations	Environmental Compliance Tracking Database, EH-41
8. Environmental Permit Exceedances	Annual Site Environmental Reports, EH-41
9. Price-Anderson Amendments Act Enforcement	Office of Enforcement and Investigation Database, EH-10
10. Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
11. Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
12. Radiological Events	Review of Occurrence Reports, EH-33
II. Precursors	
13. Near Misses and Safety Concerns	Review of Occurrence Reports, EH-33
14. Inadequate Procedures/Procedures Not Followed	Review of Occurrence Reports, EH-33
15. Safety System Actuations	Review of Occurrence Reports, EH-33
16. Safety Equipment Degradation	Review of Occurrence Reports, EH-33, Field Office Contacts
III. ES&H Management	
17. Environmental Compliance Milestones Met	EM Progress Tracking System (PTS), EH-41
18. Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
19. Enhanced Work Planning Implementation	Office of Field Support, EH-53
IV. Hazards	
20. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-66; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-67
21. Waste Generation	Waste Minimization Reporting System, EH-41
22. HEU Vulnerabilities Resolved	Office of Site Operations, DP-24 Highly Enriched Uranium ES&H Vulnerabilities Status Report, RFFO Field Office Contacts

B2. Data Analysis—Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- Looking for statistically significant trends over time,
- Comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- Normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- Examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

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Glossary

Baselines

Baselines provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data which originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes. In addition, the graphs show the historical baseline ± 1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

Total Effective Dose Equivalent (TEDE)

TEDE = External Dose Contribution + Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the "legacy" doses from previous years' exposures resulted in lower reported doses.

Price-Anderson Amendments Act (PAAA)

Price-Anderson Amendments Act (PAAA). The 1988 Price-Anderson Amendments Act extended indemnification to DOE operating contractors for consequences of a nuclear incident. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate nuclear safety rules. The regulatory basis for the enforcement program is published in 10CFR820, Procedural Rules for DOE Nuclear Activities. Enforcement actions may include the issuance of Notices of Violations and, where appropriate, civil monetary penalties of up to \$100,000 per violation per day. The mechanism allows DOE to penalize a contractor for unsafe actions or conditions while providing positive incentives for contractors to strive for an enhanced nuclear safety culture through attention to compliance to standards and requirements, self-identification of problems, reporting noncompliance's to DOE and initiating timely and effective corrective actions.

Enhanced Work Planning (EWP)

Enhanced Work Planning (EWP) is a process that evaluates and improves the program by which work is identified, planned, and executed in an efficient manner. The key elements of EWP are: a graded approach to work management, diverse teams, institutionalized communication and worker involvement from the beginning.

The following terms are related to occurrence reporting, as required by DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Occurrence Categories (Types of Occurrences)

Occurrence categories are arranged into 10 generic groups related to DOE operations and include the following:

1. Facility Condition
2. Environmental

3. Personnel Safety
4. Personnel Radiation Protection
5. Safeguards and Security
6. Transportation
7. Value Basis Reporting
8. Facility Status
9. Nuclear Explosive Safety
10. Cross-Category Items

Occurrence Categories (Types of Occurrences) continued

Severity of occurrence indicates the degree of significance associated with the different types of occurrences.

Severity of Occurrence

- Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.
- Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

Facility function identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

Facility Function

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage
- Reprocessing
- Nuclear Waste Operations
- Tritium Activities
- Fusion Activities
- Environmental Restoration Operations
- Category "A" Reactors
- Category "B" Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

Causes of occurrences are determined by performing event investigations and may be identified as direct, contributing, or root causes.

Causes of Occurrences

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that by itself, would not have caused the occurrence.

- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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Product Improvement Survey Form

Purpose of the Product - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in its strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

- | | | |
|---|------------------------------|-----------------------------|
| 1. Do you use indicators to measure performance? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. Do you feel that improved methods for measuring performance are needed? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. Would you make management decisions based on this kind of information? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Does DOE-wide ES&H performance matter to you? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. What are your information needs with regard to measuring Department-wide ES&H success: | | |
| <input type="checkbox"/> Moderate detail concerning the Department ES&H success | | |
| <input type="checkbox"/> Light detail concerning the Department ES&H success | | |
| <input type="checkbox"/> Quickpulse of the Department ES&H success | | |
| <input type="checkbox"/> I have no need for the information on a regular basis | | |

Report Evaluation - From your review of this report, *and in consideration of the purpose stated above*, mark the number that most closely corresponds to your reaction to the following statements.

- | | <i>Strongly
Agree</i> | | | <i>Neutral</i> | | | <i>Strongly
Disagree</i> |
|---|----------------------------------|------------------------------|---|-----------------------|---|-----------------------------|-------------------------------------|
| 6. The performance indicators are relevant to the measurement of overall DOE ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 7. The report layout (text and graphics) is logical and easy to understand. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 8. The data presented in this report are consistent with my impressions of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 9. The performance indicators provide a "balanced" view (e.g., successes and problems) of DOE's ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 10. This report concept can help measure DOE's success in managing and improving its ES&H performance. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| 11. This report concept can be useful in communicating information on DOE's ES&H performance to external customers. | ⑦ | ⑥ | ⑤ | ④ | ③ | ② | ① |
| <hr/> | | | | | | | |
| 12. Would you be willing to expend time/travel funds to participate in product improvement sessions? | | <input type="checkbox"/> Yes | | | | <input type="checkbox"/> No | |
| 13. Would you be willing to expend time/travel funds to participate in product improvement sessions? | | <input type="checkbox"/> Yes | | | | <input type="checkbox"/> No | |

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Page 1 of _____

From:

Name: _____

Organization: _____

Phone: _____

Comments: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and specify any general observations based on your review. Use additional pages as necessary.

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